1. If $f(x) = f(a - x)$ and $g(x) + g(a - x) = 2$, then the value of $\int_0^a f(x)\, g(x)\, dx$ is

   (a) $\int_0^a f(x)\, dx$

   (b) $\int_0^a g(x)\, dx$

   (c) $\int_0^a [g(x) - f(x)]\, dx$

   (d) $\int_0^a [g(x) + f(x)]\, dx$

2. The differential equation of the family of the curves $x^2 + y^2 - 2ax = 0$ is

   (a) $x^2 - y^2 - 2xyy'' = 0$

   (b) $y^2 - x^2 = 2xyy'$

   (c) $x^2 + y^2 + 2y'' = 0$

   (d) none of the above

3. A body falls freely from the top of a tower and during the last second of its flight it falls $\frac{5}{9}$ th of the whole distance. The height of the tower and time of motion are respectively

   (a) 44.1 m and 3s

   (b) 44.1 m and 5s

   (c) 4.41 m and 3s

   (d) none of the above

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4. The sum of the series $\frac{1}{2}+\frac{3}{4}+\frac{7}{8}+\frac{15}{16}+\ldots$ upto n terms is

(a) $n-1+\frac{1}{2^n}$ (b) $n+\frac{1}{2^n}$

(c) $2n+\frac{1}{2^n}$ (d) $n+1+\frac{1}{2^n}$

5. The equation of the plane passing through the mid point of the line of join of the points (1, 2, 3) and (3, 4, 5) and perpendicular to it is

(a) $x+y+z=9$ (b) $x+y+z=-9$

(c) $2x+3y+4z=9$ (d) $2x+3y+4z=-9$

6. The equation of the circle concentric to the circle $2x^2+2y^2-3x+6y+2=0$ and having area double the area of this circle, is

(a) $8x^2+8y^2-24x+48y-13=0$

(b) $16x^2+16y^2+24x-48y-13=0$

(c) $16x^2+16y^2-24x+48y-13=0$

(d) $8x^2+8y^2+24x-48y-13=0$

7. The domain of the function $f(x)=\frac{\cos^{-1}x}{[x]}$ is

(a) $[-1, 0)\cup\{1\}$ (b) $[-1, 1]$

(c) $[-1, 1)$ (d) none of these

8. Let $f(x)=\begin{cases}\dfrac{\tan x-\cot x}{x-\frac{\pi}{4}}, & x\neq\frac{\pi}{4}\\ a, & x=\frac{\pi}{4}\end{cases}$

the value of a so that $f(x)$ is continuous at $x=\frac{\pi}{4}$ is

(a) 2 (b) 4

(c) 3 (d) 1

9. If e and e' are the eccentricities of hyperbolas $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ and its conjugate hyperbola, then the value of $\frac{1}{e^2}+\frac{1}{e'^2}$ is

(a) 0 (b) 1

(c) 2 (d) none of these

10. The value of the $\int\frac{\sin x+\cos x}{3+\sin 2x}\,dx$ is

(a) $\frac{1}{4}\ln\left(\frac{2-\sin x+\cos x}{2+\sin x+\cos x}\right)+c$

(b) $\frac{1}{2}\ln\left(\frac{2+\sin x}{2-\sin x}\right)+c$

(c) $\frac{1}{4}\ln\left(\frac{1+\sin x}{1-\sin x}\right)+c$

(d) none of the above

11. If forces of magnitude 12 kg-wt, 5 kg-wt and 13 kg-wt act at a point are in equilibrium, then the angle between the first two forces is

(a) 30° (b) 90°

(c) 60° (d) 45°

12. For a party 8 guests are invited by a husband and his wife. They sit in a row for dinner. The probability that the husband and his wife sit together is

(a) $\frac{2}{7}$ (b) $\frac{2}{9}$

(c) $\frac{1}{9}$ (d) $\frac{4}{9}$

13. If $I_m\left(\frac{z-1}{2z+1}\right)=-4$, then locus of z is

(a) ellipse (b) parabola

(c) straight line (d) circle

14. The equation $(x-b)(x-c)+(x-a)(x-b)+(x-a)(x-c)=0$ has all its roots

(a) positive (b) real

(c) imaginary (d) negative

15. The sum of coefficients of the expansion $\left(\frac{1}{x}+2x\right)^n$ is 6561. The coefficient of term independent of x is

(a) $16\,{}^8C_4$ (b) ${}^8C_4$

(c) ${}^8C_5$ (d) none of these

16. The area enclosed between the curves $y=x$ and $y=2x-x^2$ is (in sq. unit)

(a) $\frac{1}{2}$ (b) $\frac{1}{6}$

(c) $\frac{1}{3}$ (d) $\frac{1}{4}$

17. There are 12 white and 12 red balls in a bag. Balls are drawn one by one with replacement from the bag. The probability that 7th drawn ball is 4th white is

(a) $\frac{1}{4}$ (b) $\frac{1}{8}$

(c) $\frac{1}{2}$ (d) $\frac{1}{3}$

18. In an ellipse the angle between the lines joining the foci with the positive end of minor axis is a right angle, the eccentricity of the ellipse is

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

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

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19. If $|\vec{a}| = 3$, $|\vec{b}| = 5$ and $|\vec{c}| = 4$ and $\vec{a} + \vec{b} + \vec{c} = 0$, then the value of $\vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{c}$ is equal to

(a) 0 (b) –25
(c) 25 (d) none of these

20. The equation of a line is $6x - 2 = 3y - 1 = 2z - 2$. The direction ratios of the line are

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

21. For the circuit shown below, the Boolean polynomial is

(a) $(\sim p \vee q) \vee (p \vee \sim q)$
(b) $(\sim p \wedge p) \wedge (\sim q \wedge q)$
(c) $(\sim p \wedge \sim p) \wedge (q \wedge p)$
(d) $(\sim p \wedge q) \vee (p \wedge \sim q)$

22. The value of $\int \frac{dx}{x + \sqrt{x-1}}$ is

(a) $\log(x + \sqrt{x-1}) + \sin^{-1}\left(\sqrt{\frac{x-1}{x}}\right) + c$

(b) $\log(x + \sqrt{x-1}) + c$

(c) $\log(x + \sqrt{x-1}) - \frac{2}{\sqrt{3}} \tan^{-1}\left(\frac{2\sqrt{x-1}+1}{\sqrt{3}}\right) + c$

(d) none of the above

23. If $y = \sin^{-1}\frac{x}{2} + \cos^{-1}\frac{x}{2}$, then the value of $\frac{dy}{dx}$ is

(a) 1 (b) –1
(c) 0 (d) 2

24. In Boolean algebra, the unit element '1'

(a) has two values
(b) is unique
(c) has at least two values
(d) none of the above

25. On one bank of river there is a tree. On another bank, an observer makes an angle of elevation of 60° at the top of the tree. The angle of elevation of the top of the tree at a distance 20 m away from the bank is 30°. The width of the river is

(a) 20 m (b) 10 m
(c) 5 m (d) 1 m

26. The magnitude of cross product of two vectors is $\sqrt{3}$ times the dot product. The angle between the vectors is

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{3}$
(c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$

27. If $D_r = \begin{vmatrix} r & 1 & \frac{n(n+1)}{2} \\ 2r-1 & 4 & n^2 \\ 2^{r-1} & 5 & 2^n - 1 \end{vmatrix}$, then the value of $\sum_{r=0}^{n} D_r$ is

(a) 0
(b) 1
(c) $\frac{n(n+1)(2n+1)}{6}$
(d) none of these

28. If $\begin{vmatrix} -12 & 0 & \lambda \\ 0 & 2 & -1 \\ 2 & 1 & 15 \end{vmatrix} = -360$, then the value of λ is

(a) –1 (b) –2
(c) –3 (d) 4

29. If $A = \begin{bmatrix} 1 & x \\ x^2 & 4y \end{bmatrix}$ and $B = \begin{bmatrix} -3 & 1 \\ 1 & 0 \end{bmatrix}$ adj. $A + B = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then values of x and y are

(a) 1, 1
(b) ± 1, 1
(c) 1, 0
(d) none of these

30. If $\tan^{-1}\frac{1-x}{1+x} = \frac{1}{2}\tan^{-1} x$, then the value of x is

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

31. If $x^{2/3} - 7x^{1/3} + 10 = 0$ then, the value of x is

(a) {125} (b) {8}
(c) ϕ (d) {125, 8}

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32. The value of

$$\lim_{\alpha \to 0} \frac{\text{cosec}^{-1}(\sec\alpha) + \cot^{-1}(\tan\alpha) + \cot^{-1}\cos(\sin^{-1}\alpha)}{\alpha}$$ is

(a) 0 (b) −1
(c) −2 (d) 1

33. If the second term in the expansion $\left[\sqrt[13]{a} + \frac{a}{\sqrt{a^{-1}}}\right]^n$ is $14a^{5/2}$, then the value of $\frac{{}^nC_3}{{}^nC_2}$ is

(a) 4 (b) 3
(c) 12 (d) 6

34. One of the diameter of the circle $x^2 + y^2 - 12x + 4y + 6 = 0$ is given by

(a) $x + y = 0$
(b) $x + 3y = 0$
(c) $x = y$
(d) $3x + 2y = 0$

35. Point D, E are taken on the side BC of the triangle ABC, such that $BD = DE = EC$. If $\angle BAD = x$, $\angle DAE = y$, $\angle EAC = z$, then the value of $\frac{\sin(x+y)\sin(y+z)}{\sin x \sin z}$ is equal to

(a) 1 (b) 2
(c) 4 (d) none of these

36. The number of real solution of

$\tan^{-1}\sqrt{x(x+1)} + \sin^{-1}\sqrt{x^2 + x + 1} = \frac{\pi}{2}$ is

(a) zero (b) one
(c) two (d) infinite

37. The equation $\sin^{-1} x - \cos^{-1} x = \cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$ has

(a) no solution
(b) unique solution
(c) infinite number of solution
(d) none of the above

38. In a ΔABC, a, c, A are given and b_1, b_2 are two values, if the third side b such that $b_2 = 2b_1$ then $\sin A$ is equal to

(a) $\frac{\sqrt{9a^2 - c^2}}{8a^2}$ (b) $\sqrt{\frac{9a^2 - c^2}{8c^2}}$
(c) $\sqrt{\frac{9a^2 + c^2}{8a^2}}$ (d) none of these

39. A variable chord is drawn through the origin to the circle $x^2 + y^2 - 2ax = 0$. The locus of the centre of the circle drawn on this chord as diameter is

(a) $x^2 + y^2 + ax = 0$
(b) $x^2 + y^2 - ax = 0$
(c) $x^2 + y^2 + ay = 0$
(d) $x^2 + y^2 - ay = 0$

40. If $1, a_1, a_2, \ldots, a_{n-1}$ are the n roots of unity, then the value of $(1 - a_1)(1 - a_2)(1 - a_3)\ldots$ $\ldots (1 - a_{n-1})$ is equal to

(a) $\sqrt{3}$ (b) $\frac{1}{2}$
(c) n (d) 0

41. Let a, b, c be real. If $ax^2 + bx + c = 0$ has two real roots α and β, where $\alpha < -1$ and $\beta > 1$, then $1 + \frac{c}{a} + \left|\frac{b}{a}\right|$ is

(a) < 0 (b) > 0
(c) ≤ 0 (d) none of these

42. Number of divisiors of the form $(4n + 2)$, $n \geq 0$ of the integer 240 is

(a) 4 (b) 8
(c) 10 (d) 3

43. The expression $\{x + (x^3 - 1)^{1/2}\}^5 + \{x - (x^3 - 1)^{1/2}\}^5$ is a polynomial of degree

(a) 5 (b) 6
(c) 7 (d) 8

44. Let a, b, c be positive and not all equal, the value of the determinant $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ is

(a) +ve (b) −ve
(c) zero (d) none of these

45. $\lim_{h \to 0} \frac{(a+h)^2 \sin(a+h) - a^2 \sin a}{h}$ is equal to

(a) $2a \sin a$
(b) $a^2 \cos a$
(c) $a^2 \cos a + 2a \sin a$
(d) none of these

46. If $f(x) = x(\sqrt{x} + \sqrt{x+1})$, then

(a) $f(x)$ is continuous but not differentiable at $x = 0$
(b) $f(x)$ is differentiable at $x = 0$
(c) $f(x)$ is not differentiable at $x = 0$
(d) none of these

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47. If y is a function of x and $\log(x+y) = 2xy$, then the value of $y'(0)$ is equal to

(a) 1 (b) -1

(c) 2 (d) 0

48. The angle between the tangent drawn from the point (1, 4) to the parabola $y^2 = 4x$ is

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$

(c) $\frac{\pi}{3}$ (d) $\frac{\pi}{2}$

49. If $y = a\log x + bx^2 + x$ has its extremum value at $x = -1$ and $x = 2$, then

(a) $a = 2, b = -1$

(b) $a = 2, b = -\frac{1}{2}$

(c) $a = -2, b = \frac{1}{2}$

(d) none of the above

50. The value of $\int \frac{dx}{x^2(x^4+1)^{3/4}}$ is

(a) $-\frac{(x^4+1)^{1/4}}{x} + c$

(b) $\frac{(x^4+1)^{1/4}}{x} + c$

(c) zero

(d) none of the above

Answer – Key

1. a	2. b	3. a	4. a	5. a	6. c	7. a	8. b	9. b	10. a
11. b	12. b	13. d	14. b	15. a	16. b	17. c	18. a	19. b	20. a
21. d	22. c	23. c	24. b	25. b	26. b	27. a	28. c	29. a	30. b
31. d	32. c	33. a	34. b	35. c	36. c	37. b	38. b	39. b	40. c
41. a	42. a	43. c	44. b	45. c	46. c	47. a	48. c	49. b	50. a

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