1. The value of $\sum_{n=1}^{13}(i^n + i^{n+1})$, where $i = \sqrt{-1}$ equals
   (a) i (b) $i - 1$
   (c) $-i$ (d) 0

2. If $4 \sin^{-1} x + \cos^{-1} x = \pi$, then the value of x is
   (a) 0 (b) 1/2
   (c) 1 (d) -1

3. There are n different books and p copies of each. The number of ways in which a selection can be made from them, is
   (a) n^p (b) p^n
   (c) $(p+1)^n - 1$ (d) $(n+1)^p - 1$

4. The circle S_1 with centre C_1 (a_1, b_1) and radius r_1 touches externally the circle S_2 with centre C_2 (a_2, b_2) and radius r_2. If the tangent at their common point passes through the origin, then
   (a) $(a_1^2 + a_2^2) + (b_1^2 + b_2^2) = r_1^2 + r_2^2$
   (b) $(a_1^2 - a_2^2) + (b_1^2 - b_2^2) = r_1^2 - r_2^2$
   (c) $(a_1^2 - b_2)^2 + (a_2^2 + b_2^2) = r_1^2 + r_2^2$
   (d) $(a_1^2 - b_1^2) + (a_1^2 + b_2^2) = r_1^2 + r_2^2$

5. If three vectors **a**, **b**, **c** are such that $\mathbf{a} \neq 0$ and $\mathbf{a} \times \mathbf{b} = 2(\mathbf{a} \times \mathbf{c})$, $|\mathbf{a}| = |\mathbf{c}| = 1$, $|\mathbf{b}| = 4$ and the angle between **b** and **c** is $\cos^{-1}\left(\frac{1}{4}\right)$. Also $\mathbf{b} - 2\mathbf{c} = \lambda \mathbf{a}$, then find the value of λ
   (a) ± 4 (b) 14
   (c) ± 2 (d) 12

6. A vector which makes equal angle with the vectors $1/3\,(\mathbf{i} - 2\mathbf{j} + 2\mathbf{k})$, $1/5\,(-4\mathbf{i} - 3\mathbf{k})$ and **j** is
   (a) $5\mathbf{i} + \mathbf{j} + 5\mathbf{k}$ (b) $-6\mathbf{i} + \mathbf{j} + 5\mathbf{k}$
   (c) $5\mathbf{i} - \mathbf{j} - 5\mathbf{k}$ (d) $5\mathbf{i} + \mathbf{j} - 5\mathbf{k}$

7. If $\mathbf{a} \cdot \mathbf{b} = 0$ and $\mathbf{a} + \mathbf{b}$ makes an angle of 30° with **a**, then
   (a) $|\mathbf{b}| = 2|\mathbf{a}|$ (b) $|\mathbf{a}| = 2|\mathbf{b}|$
   (c) $|\mathbf{a}| = \sqrt{3}|\mathbf{b}|$ (d) None of these

8. In Simpson's one-third rule the curve $y = f(x)$ is assumed to be a
   (a) circle (b) parabola
   (c) hyperbola (d) None of these

9. Objective of LPP is
   (a) a constraint
   (b) a function to be optimized
   (c) a relation between the variables
   (d) None of the above

10. The variance of first 'n' natural number is
   (a) $\frac{n^2+1}{12}$ (b) $\frac{n^2-1}{12}$
   (c) $\frac{(n+1)(2n+1)}{6}$ (d) None of these

11. In Boolean algebra, which of the following statement is correct
   (a) $(a+b)' = a' + b'$
   (b) $(a+b)' = a' \cdot b'$
   (c) $(a+b)' = (a' \cdot b')$
   (d) None of the above

12. The function x^x decreases in the interval
   (a) $(0, e)$ (b) $(0, 1)$
   (c) $(0, 1/e)$ (d) None of these

13. The period of the function $f(x) = (\sin 3x) + |\cos 6x|$ is
   (a) π (b) $2\pi/3$ (c) 2π (d) $\pi/2$

14. The differential equation representing the family of curves $y^2 = 2c(x + \sqrt{c})$, where c is a positive perimeter, is of
   (a) order 1, degree 3 (b) order 2, degree 2
   (c) degree 3, order 3 (d) degree 4, order 4

15. If $\int \sqrt{1+\sin x} \cdot f(x)\, dx = \frac{2}{3}(1+\sin x)^{3/2} + C$, then $f(x)$ is equal to

(a) $\cos x$ (b) $\sin x$
(c) $\tan x$ (d) 1

16. $\int x \sqrt{\frac{1-x}{1+x}}\, dx$ is equal to

(a) $\left(\frac{x}{2} - 1\right)\sqrt{1-x^2} + \frac{1}{2}\sin^{-1} x + C$

(b) $\left(\frac{x}{2} - 1\right)\sqrt{1-x^2} - \frac{1}{2}\sin^{-1} x + C$

(c) $\sqrt{1-x^2} + \frac{1}{2}\sin^{-1} x + C$

(d) None of the above

17. If $x = \sec\theta - \cos\theta$ and $y = \sec^n\theta - \cos^n\theta$, then $\left(\frac{dy}{dx}\right)^2$ is

(a) $\frac{n^2(y^2+4)}{x^2+4}$ (b) $\frac{n^2(y^2-4)}{x^2}$
(c) $n\frac{(y^2-4)}{x^2-4}$ (d) $\left(\frac{n\,y}{x}\right)^2 - 4$

18. The area formed by triangular shaped region bounded by the curves $y = \sin x$, $y = \cos x$ and $x = 0$ is

(a) $(\sqrt{2}-1)$ sq unit (b) 1 sq unit
(c) $\sqrt{2}$ sq units (d) $(\sqrt{2}+1)$ sq units

19. Find the value of $\int_0^{\pi/2} \frac{dx}{1+\tan^3 x}$

(a) 0 (b) 1
(c) $\pi/2$ (d) $\pi/4$

20. The angle of intersection of the curve $y = x^2$ and $6y = 7 - x^3$ at (1, 1) is

(a) $\pi/4$ (b) $\pi/3$
(c) $\pi/2$ (d) None of these

21. If $I_{m,n} = \int_0^1 x^m (\log x)^n\, dx$, then it is equal to

(a) $\frac{n}{n+1} I_{m,n-1}$ (b) $\frac{-m}{n+1} I_{m,n-1}$
(c) $\frac{-n}{m+1} I_{m,n-1}$ (d) $\frac{m}{n+1} I_{m,n-1}$

22. $\frac{d}{dx}\operatorname{cosec}^{-1}\left(\frac{1+x^2}{2x}\right)$ is equal to

(a) $\frac{-2}{(1+x^2)}, x \neq 0$

(b) $\frac{2}{(1+x^2)}, x \neq 0$

(c) $\frac{2(1-x^2)}{(1+x^2)|1-x^2|}, x \neq \pm 1, 0$

(d) None of the above

23. If $\lim_{x\to 0} \phi(x) = a^3, a \neq 0$, then $\lim_{x\to 0} \phi(x/a)$ is equal to

(a) a^2 (b) $1/a^3$
(c) $1/a^2$ (d) a^3

24. If $(1+\tan\theta)(1+\tan\phi) = 2$, then $(\theta+\phi)$ is equal to

(a) 30° (b) 45°
(c) 60° (d) 75°

25. If in a ΔABC, $\cos A + \cos B + \cos C = 3/2$, then triangle is

(a) right angled (b) isosceles
(c) acute (d) equilateral

26. If the line $x - 1 = 0$ is the directrix of parabola $y^2 - kx + 8 = 0$, then one of the value of k is

(a) 1/8 (b) 8
(c) 4 (d) 1/4

27. The centre of the sphere through the points (0, 3, 4), (0, 5, 0), (4, 0, 3) and (– 3, 4, 0) is

(a) (1/4, 3, 7/4) (b) (0, 0, 0)
(c) (– 4, 3, 0) (d) None of these

28. Solve $(y \log x - 1)\, y\, dx = x\, dy$

(a) $y(\log ex + cx) = 1$
(b) $y = (\log ex + cx)$
(c) $y(\log ex - (x)) = -1$
(d) None of the above

29. If $f(x) = \int_{-1}^{x} |t|\, dt, x \geq -1$, then

(a) f and f' are continuous for $x + 1 > 0$
(b) f is continuous but f' is not continuous for $x + 1 > 0$
(c) f and f' are not continuous at $x = 0$
(d) f is continuous at $x = 0$ but f' is not so

30. AB, AC are tangents to a parabola $y^2 = 4ax$, if l_1, l_2, l_3 are the lengths of perpendiculars from A, B, C on any tangents to the parabola, then
(a) l_1, l_2, l_3 are in GP
(b) l_2, l_1, l_3 are in GP
(c) l_3, l_1, l_2 are in GP
(d) l_3, l_2, l_1 are in GP

31. A family of lines is given by $(1+2\lambda)x + (1-\lambda)y + \lambda = 0$, λ being the parameter. The line belonging to this family at the maximum distance from the point (1,4) is
(a) $4x - y + 1 = 0$ (b) $33x + 12y + 7 = 0$
(c) $12x + 33y = 7$ (d) None of these

32. If the eccentricity of the hyperbola $x^2 - y^2 \sec^2\alpha = 5$ is $\sqrt{3}$ times the eccentricity of the ellipse $x^2 \sec^2\alpha + y^2 = 25$, then the value of α is
(a) $\pi/6$ (b) $\pi/4$
(c) $\pi/3$ (d) $\pi/2$

33. Lines of regressions of y on x and x on y are respectively $y = ax + b$ and $x = \alpha y + \beta$. If mean of x and y series is same, then its value is
(a) $\frac{b}{1-a}$ (b) $\frac{1-a}{b}$
(c) $\frac{\beta}{1-\beta}$ (d) $\frac{\alpha}{1-\alpha}$

34. A solution of the differential equation $\left(\frac{dy}{dx}\right)^2 - x\frac{dy}{dx} + y = 0$ is
(a) $y = 2$ (b) $y = 2x$
(c) $y = 2x - 4$ (d) $y = 2x^2 - 4$

35. The relation between the time t and distance 'x' is given by $t = px^2 + qx$, where p and q are constants. The relation between velocity v and acceleration f is
(a) $f \propto v$ (b) $f \propto v^4$
(c) $f \propto v^2$ (d) $f \propto v^3$

36. The product of $x^{1/2} \cdot x^{1/4} \cdot x^{1/8} \ldots \infty$ equals
(a) 0 (b) 1
(c) x (d) ∞

37. If the equation $x^2 + ix + a = 0$, $x^2 - 2x + ia = 0$, $a \neq 0$ have a common root, then
(a) a is real
(b) $a = 1/2 + i$
(c) $a = 1/2 - i$
(d) the other root is also common

38. The distance between the lines $y = 2x + 4$ and $3y = 6x - 5$ is equal to
(a) 1 (b) $3/\sqrt{5}$
(c) $\frac{17\sqrt{5}}{15}$ (d) $\frac{17}{\sqrt{3}}$

39. The equation $\frac{x^2}{12-k} + \frac{y^2}{8-k} = 1$ represents
(a) a hyperbola, if $k < 8$
(b) an ellipse, if $k > 8$
(c) a hyperbola, if $8 < k < 12$
(d) None of the above

40. The series
$$\frac{1}{(n+1)} + \frac{1}{2(n+1)^2} + \frac{1}{3(n+1)^3} + \ldots$$
has the same sum as the series
(a) $\frac{1}{n} - \frac{1}{2n^2} + \frac{1}{3n^3} - \frac{1}{4n^4} + \ldots$
(b) $\frac{1}{n} + \frac{1}{2n^2} + \frac{1}{3n^3} + \frac{1}{4n^4} + \ldots$
(c) $\frac{1}{n} + \frac{1}{2^2}\cdot\frac{1}{n^2} + \frac{1}{2^3}\cdot\frac{1}{n^3} + \ldots$
(d) None of the above

41. The sum of the infinite series $\frac{2}{3!} + \frac{4}{5!} + \frac{6}{7!} + \frac{8}{9!} + \ldots \infty$ is
(a) e (b) e^{-1} (c) $2e$ (d) e^2

42. If the roots of the equation $a(b-c)x^2 + b(c-a)x + c(a-b) = 0$ are equal, then a, b, c are in
(a) AP (b) GP
(c) HP (d) None of these

43. The probability that a person will hit a target in shooting practice is 0.3. If he shoots 10 times, then the probability of his shooting the target is
(a) 1 (b) $1 - (0.7)^{10}$
(c) $(0.7)^{10}$ (d) $(0.3)^{10}$

44. Let A and B be two events such that $P(A) = 0.3$ and $P(A \cup B) = 0.8$. If A and B are independent events. Then, $P(B)$ is equal to

(a) 5/7 (b) 2/3
(c) 1 (d) None of these

45. 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 $x \in \left[\frac{-\pi}{4}, \frac{\pi}{4}\right]$ is

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

46. If $A = \begin{vmatrix} a & 0 & 0 \\ 0 & a & 0 \\ 0 & 0 & a \end{vmatrix}$, then the value of $|A||\text{adj}(A)|$ is

(a) a^3 (b) a^6
(c) a^9 (d) a^{27}

47. The term independent of x in $\left[\sqrt{\frac{x}{3}} + \sqrt{\frac{3}{2x^2}}\right]^{10}$ is

(a) ${}^{10}C_1$ (b) 5/12
(c) 1 (d) None of these

48. $\frac{\frac{1}{2}\cdot\frac{2}{2}}{1^3} + \frac{\frac{2}{2}\cdot\frac{3}{2}}{1^3+2^3} + \frac{\frac{3}{2}\cdot\frac{4}{2}}{1^3+2^3+3^3} + \ldots$ upto n terms

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

49. The solution of the equation $\cos^2\theta + \sin\theta + 1 = 0$, lies in the interval

(a) $\left(\frac{-\pi}{4}, \frac{\pi}{4}\right)$ (b) $\left(\frac{\pi}{4}, \frac{3\pi}{4}\right)$
(c) $\left(\frac{3\pi}{4}, \frac{5\pi}{4}\right)$ (d) $\left(\frac{5\pi}{4}, \frac{7\pi}{4}\right)$

50. $\log_3 2, \log_6 2, \log_{12} 2$ are in

(a) AP (b) GP
(c) HP (d) None of these

Answer – Key

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