1. $\sim p \wedge q$ is logically equivalent to :
   (a) $p \rightarrow q$ (b) $q \rightarrow p$
   (c) $\sim (p \rightarrow q)$ (d) $\sim (q \rightarrow p)$

2. Which of the following is the inverse of the proposition : "If a number is a prime then it is odd" ?
   (a) If a number is not a prime then it is odd
   (b) If a number is not a prime then it is not odd
   (c) If a number is not odd then it is not a prime
   (d) If a number is odd then it is a prime

3. What must be the matrix X if $2X + \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 8 \\ 7 & 2 \end{bmatrix}$?
   (a) $\begin{bmatrix} 1 & 3 \\ 2 & -1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & -3 \\ 2 & -1 \end{bmatrix}$
   (c) $\begin{bmatrix} 2 & 6 \\ 4 & -2 \end{bmatrix}$ (d) $\begin{bmatrix} 2 & -6 \\ 4 & -2 \end{bmatrix}$

4. The value of $\begin{vmatrix} 1 & 1 & 1 \\ bc & ca & ab \\ b+c & c+a & a+b \end{vmatrix}$ is :
   (a) 1
   (b) 0
   (c) $(a-b)(b-c)(c-a)$
   (d) $(a+b)(b+c)(c+a)$

5. The value of $\begin{vmatrix} 441 & 442 & 443 \\ 445 & 446 & 447 \\ 449 & 450 & 451 \end{vmatrix}$ is :
   (a) $441 \times 446 \times 4510$ (b) 0
   (c) -1 (d) 1

6. $(\vec{a} . \hat{i})\,\hat{i} + (\vec{a} . \hat{j})\,\hat{j} + (\vec{a} . \hat{k})\,\hat{k}$ is equal to :
   (a) $\vec{a}$ (b) $2\vec{a}$
   (c) $3\vec{a}$ (d) $\vec{0}$

7. Inverse of the matrix $\begin{bmatrix} \cos 2\theta & -\sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix}$ is :
   (a) $\begin{bmatrix} \cos 2\theta & -\sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix}$
   (b) $\begin{bmatrix} \cos 2\theta & \sin 2\theta \\ \sin 2\theta & -\cos 2\theta \end{bmatrix}$
   (c) $\begin{bmatrix} \cos 2\theta & \sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix}$
   (d) $\begin{bmatrix} \cos 2\theta & \sin 2\theta \\ -\sin 2\theta & \cos 2\theta \end{bmatrix}$

8. If $|\vec{a}| = 3$, $|\vec{b}| = 4$, then a value of λ for which $\vec{a} + \lambda\vec{b}$ is perpendicular to $\vec{a} - \lambda\vec{b}$ is :
   (a) $\frac{9}{16}$ (b) $\frac{3}{4}$
   (c) $\frac{3}{2}$ (d) $\frac{4}{3}$

9. The projection of $\vec{a} = 2\hat{i} + 3\hat{j} - 2\hat{k}$ on $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$ is :
   (a) $\frac{1}{\sqrt{14}}$ (b) $\frac{2}{\sqrt{14}}$
   (c) $\sqrt{14}$ (d) $\frac{-2}{\sqrt{14}}$

10. In the group (1, 2, 3, 4, 5, 6) under multiplication modulo 7, $2^{-1} \times 4$ is equal to :
(a) 1 (b) 4
(c) 2 (d) 3

11. The maximum of the function $3\cos x - 4\sin x$ is :
(a) 2 (b) 3
(c) 4 (d) 5

12. If the distance 's' metres traversed by a particle in t seconds is given by $s = t^3 - 3t^2$, then the velocity of the particle when the acceleration is zero, in metre/sec. is :
(a) 3 (b) – 2
(c) – 3 (d) 2

13. For the curve $y^n = a^{n-1}\, x$ if the subnormal at any point is a constant then n is equal to :
(a) 1 (b) 2
(c) – 2 (d) – 1

14. If $x = A\cos 4t + B\sin 4t$ then $\frac{d^2x}{dt^2}$ is equal to :
(a) $-16\,x$ (b) $16\,x$
(c) x (d) $-x$

15. If tangent to the curve $x = at^2, y = 2at$ is perpendicular to x-axis, then its point of contact is :
(a) (a, a) (b) $(0, a)$
(c) $(0, 0)$ (d) $(a, 0)$

16. The general solution of the differential equation $\frac{dy}{dx} + \frac{1+\cos 2y}{1-\cos 2y} = 0$ is given by :
(a) $\tan y + \cot x = c$
(b) $\tan y - \cot x = c$
(c) $\tan x - \cot y = c$
(d) $\tan x + \cot x = c$

17. The degree of the differential equation $\left(1 + \left(\frac{dy}{dx}\right)^2\right)^{3/4} = \left(\frac{d^2y}{dx^2}\right)^{1/3}$ is :
(a) 2 (b) 4
(c) 9 (d) 1

18. The area enclosed between the curves $y = x^3$ and $y = \sqrt{x}$ is, (in square units) :
(a) $\frac{5}{3}$ (b) $\frac{5}{4}$
(c) $\frac{5}{12}$ (d) $\frac{12}{5}$

19. $\int_0^{\pi/8} \cos^3 4\theta\, d\theta$ is equal to :
(a) $\frac{5}{3}$ (b) $\frac{5}{4}$
(c) $\frac{1}{3}$ (d) $\frac{1}{6}$

20. $\int_0^{\pi/2} \frac{\cos x - \sin x}{1 + \cos x \sin x}\, dx$ is equal to :
(a) 0 (b) $\frac{\pi}{2}$
(c) $\frac{\pi}{4}$ (d) $\frac{\pi}{6}$

21. If $ax^2 - y^2 + 4x - y = 0$ represents a pair of lines, then a is equal to :
(a) – 16 (b) 16
(c) 4 (d) – 4

22. What is the equation of the locus of a point which moves such that 4 times its distance from the x-axis is the square of its distance from the origin ?
(a) $x^2 + y^2 - 4y = 0$ (b) $x^2 + y^2 - 4|y| = 0$
(c) $x^2 + y^2 - 4x = 0$ (d) $x^2 + y^2 - 4|x| = 0$

23. Equation of the straight line making equal intercepts on the axes and passing through the point (2, 4) is :
(a) $4x - y - 4 = 0$ (b) $2x + y - 8 = 0$
(c) $x + y - 6 = 0$ (d) $x + 2y - 10 = 0$

24. If the area of the triangle with vertices $(x, 0)$, (1, 1) and (0, 2) is 4 square units, then the value of x is :
(a) – 2
(b) – 4
(c) – 6
(d) 8

25. $\lim_{\theta \to \frac{\pi}{2}} \frac{\frac{\pi}{2} - \theta}{\cot \theta}$

(a) 0 (b) – 1
(c) 1 (d) ∞

26. The co-axial system of circles given by $x^2 + y^2 + 2gx + c = 0$ for $c < 0$ represents :
(a) intersecting circles
(b) non intersecting circles
(c) touching circles
(d) touching or non-intersecting circles

27. The radius of the circle passing through the point (6, 2) and two of whose diameters are $x + y = 6$ and $x + 2y = 4$ is :
(a) 4 (b) 6
(c) 20 (d) $\sqrt{20}$

28. If (0, 6) and (0, 3) are respectively the vertex and focus of a parabola, then its equation is :
(a) $x^2 + 12y = 72$ (b) $x^2 - 12y = 72$
(c) $y^2 - 12x = 72$ (d) $y^2 + 12x = 72$

29. For the ellipse $24x^2 + 9y^2 - 150x - 90y + 225 = 0$ the eccentricity e is equal to :
(a) $\frac{2}{5}$ (b) $\frac{3}{5}$
(c) $\frac{4}{5}$ (d) $\frac{1}{5}$

30. If the foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$ and the hyperbola $\frac{x^2}{144} - \frac{y^2}{81} = \frac{1}{25}$ coincide, then the value of b^2 is :
(a) 1 (b) 7
(c) 5 (d) 9

31. The differential coefficient is $f(\sin x)$ with respect to x where $f(x) = \log x$ is :
(a) $\tan x$ (b) $\cot x$
(c) $f(\cos x)$ (d) $\frac{1}{x}$

32. If $f(x) = \begin{cases} \frac{1 - \cos x}{x} & x \neq 0 \\ k & x = 0 \end{cases}$ is continuous at $x = 0$, then the value of k is :
(a) 0 (b) $\frac{1}{2}$
(c) $\frac{1}{4}$ (d) $-\frac{1}{2}$

33. If $\omega = \frac{-1 + \sqrt{3}i}{2}$ then $(3 + \omega + 3\omega^2)^4$ is :
(a) 16 (b) – 16
(c) 16 ω (d) 16 ω^2

34. If $y = \tan^{-1}(\sec x - \tan x)$, then $\frac{dy}{dx}$ is equal to :
(a) 2 (b) – 2
(c) $\frac{1}{2}$ (d) $-\frac{1}{2}$

35. If $x + \frac{1}{x} = 2 \cos \alpha$ then $x^n + \frac{1}{x^n}$ is equal to :
(a) $2^n \cos \alpha$ (b) $2^n \cos n\alpha$
(c) $2i \sin n\alpha$ (d) $2 \cos n\alpha$

36. $\int_{-1}^{1} |1 - x| \, dx$ is equal to :
(a) – 2
(b) 0
(c) 2
(d) 4

37. $\int \frac{dx}{x(x^7 + 1)}$ is equal to :
(a) $\log\left(\frac{x^7}{x^7 + 1}\right) + c$ (b) $\frac{1}{7}\log\left(\frac{x^7}{x^7 + 1}\right) + c$
(c) $\log\left(\frac{x^7 + 1}{x^7}\right) + c$ (d) $\frac{1}{7}\log\left(\frac{x^7 + 1}{x^7}\right) + c$

38. $\int \sqrt{x}\, e^{\sqrt{x}}\, dx$ is equal to :
(a) $2\sqrt{x} - e^{\sqrt{x}} - 4\sqrt{x e^{\sqrt{x}}} + c$
(b) $(2x - 4\sqrt{x} + 4)e^{\sqrt{x}} + c$
(c) $(2x + 4\sqrt{x} + 4)e^{\sqrt{x}} + c$
(d) $(1 - 4\sqrt{x})\, e^{\sqrt{x}} + c$

39. $\int \frac{dx}{x^2+2x+2}$ is equal to :

(a) $\sin^{-1}(x+1)+c$

(b) $\sin h^{-1}(x+1)+c$

(c) $\tan h^{-1}(x+1)+c$

(d) $\tan^{-1}(x+1)+c$

40. If a tangent to the curve $y=6x-x^2$ is parallel to the line $4x-2y-1=0$, then the point of tangency on the curve is :

(a) (2, 8) (b) (8, 2)

(c) (6, 1) (d) (4, 2)

41. 0.5737373 ... is equal to :

(a) $\frac{284}{497}$ (b) $\frac{284}{495}$

(c) $\frac{568}{999}$ (d) $\frac{567}{990}$

42. The number of solutions for the equation $x^2-5|x|+6=0$ is :

(a) 4 (b) 3

(c) 2 (d) 1

43. How many numbers of 6 digits can be formed from the digits of the number 112233 ?

(a) 30 (b) 60

(c) 90 (d) 120

44. The last digit in 7^{300} is :

(a) 7 (b) 9

(c) 1 (d) 3

45. If $\frac{\log x}{a-b}=\frac{\log y}{b-c}=\frac{\log z}{c-a}$, then xyz is equal to :

(a) 0 (b) 1

(c) -1 (d) 2

46. The smallest positive integer n for which $(1+i)^{2n}=(1-i)^{2n}$ is :

(a) 1 (b) 2

(c) 3 (d) 4

47. If $\cos^{-1}p+\cos^{-1}q+\cos^{-1}r=\pi$ then $p^2+q^2+r^2+2pqr$ is equal to :

(a) 3 (b) 1

(c) 2 (d) -1

48. If $\sin^{-1}\frac{x}{5}+\text{cosec}^{-1}\frac{5}{4}=\frac{\pi}{2}$, then x is equal to :

(a) 1 (b) 4

(c) 3 (d) 5

49. If $0\le x\le\pi$ and $81^{\sin^2 x}+81^{\cos^2 x}=30$, then x is equal to :

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

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

50. The equation of the director circle of the hyperbola $\frac{x^2}{16}-\frac{y^2}{4}=1$ is given by :

(a) $x^2+y^2=16$

(b) $x^2+y^2=4$

(c) $x^2+y^2=20$

(d) $x^2+y^2=12$

51. If Q_1 is the set of all relations other than 1 with the binary operation * defined by $a*b=a+b-ab$ for all a, b in Q_1, then the identity in Q_1 with respect to * is :

(a) 1

(b) 0

(c) -1

(d) 2

52. The circle $x^2+y^2-8x+4y+4=0$ touches :

(a) x-axis

(b) y-axis

(c) both axis

(d) neither x-axis nor y-axis

53. Which of the following is true ?

(a) The set of all fourth roots of unity is a multiplicative group

(b) The set of all cube roots of unity is an additive group

(c) $(ab)^{-1}=a^{-1}b^{-1}$ for all a, b in any group G

(d) If $(ab)^2=a^2b^2$ for all a, b in any group G, then the group G is non abelian

54. The set of all integral multiples of 5 is a subgroup of :
(a) The set of all rational numbers under multiplication
(b) The set of all integers under multiplication
(c) The set of all non zero rational numbers under multiplication
(d) The set of all integers under addition

55. The value of k so that $x^2 + y^2 + kx + 4y + 2 = 0$ and $2(x^2 + y^2) - 4x - 3y + k = 0$ cut orthogonally is :
(a) $\frac{10}{3}$ (b) $-\frac{8}{3}$
(c) $-\frac{10}{3}$ (d) $\frac{8}{3}$

56. $\lim_{x \to \infty} \left(1 - \frac{4}{x-1}\right)^{3x-1}$ is equal to :
(a) e^{12} (b) e^{-12}
(c) e^4 (d) e^3

57. If $A + B + C = 180°$ then $\Sigma \tan \frac{A}{2} \tan \frac{B}{2}$ is equal to :
(a) 0 (b) 1
(c) 2 (d) 3

58. In a triangle ABC if $b = 2$, $B = 30°$ then the area of the circumcircle of triangle ABC in square units is :
(a) π (b) 2π
(c) 4π (d) 6π

59. If $\sin x + \sin^2 x = 1$, then $\cos^{12} x + 3\cos^{10} x + 3\cos^8 x + \cos^6 x$ is equal to :
(a) 1 (b) 2
(c) 3 (d) 0

60. If R denotes the set of all real number, then the function $f: R \to R$ defined $f(x) = |x|$ is :
(a) one-one only
(b) onto only
(c) both one-one and onto
(d) neither one-one nor onto

Answer – Key

1. d	**2.** b	**3.** a	**4.** c	**5.** b	**6.** a	**7.** d	**8.** b	**9.** b	**10.** c
11. d	**12.** c	**13.** b	**14.** a	**15.** c	**16.** b	**17.** b	**18.** c	**19.** d	**20.** a
21. b	**22.** b	**23.** c	**24.** c	**25.** c	**26.** a	**27.** d	**28.** a	**29.** c	**30.** b
31. b	**32.** a	**33.** c	**34.** d	**35.** d	**36.** c	**37.** b	**38.** b	**39.** d	**40.** a
41. b	**42.** a	**43.** c	**44.** c	**45.** b	**46.** b	**47.** b	**48.** c	**49.** a	**50.** d
51. b	**52.** b	**53.** a	**54.** d	**55.** b	**56.** b	**57.** b	**58.** c	**59.** a	**60.** d