1. If F is function such that $F(0) = 2$, $F(1) = 3$, $F(x+2) = 2F(x) - F(x+1)$ for $x \geq 0$, then $F(5)$ is equal to
   (a) -7 (b) -3
   (c) 17 (d) 13
2. Let S be a set containing n elements. Then, number of binary operations on S is
   (a) n^n (b) 2^{n^2}
   (c) n^{n^2} (d) n^2
3. The numerically greatest term in the expansion of $(3-5x)^{11}$ when $x = \frac{1}{5}$, is
   (a) 55×3^9 (b) 55×3^6
   (c) 45×3^9 (d) 45×3^6
4. The number of solutions of the equation $\sin(e^x) = 5^x + 5^{-x}$, is
   (a) 0 (b) 1
   (c) 2 (d) infinitely many
5. If $a^x = b^y = c^z = d^u$ and a, b, c, d are in GP, then x, y, z, u are in
   (a) AP (b) GP
   (c) HP (d) None of these
6. If z satisfies the equation $|z| - z = 1 + 2i$, then z is equal to
   (a) $\frac{3}{2} + 2i$ (b) $\frac{3}{2} - 2i$
   (c) $2 - \frac{3}{2}i$ (d) $2 + \frac{3}{2}i$

7. If $z = \frac{1 - i\sqrt{3}}{1 + i\sqrt{3}}$, then arg (z) is

(a) $60°$ (b) $120°$
(c) $240°$ (d) $300°$

8. If $f(x) = \sqrt{\log_{10} x^2}$. The set of all values of x for which $f(x)$ is real, is

(a) $[-1, 1]$
(b) $[1, \infty)$
(c) $(-\infty, -1]$
(d) $(-\infty, -1] \cup [1, \infty)$

9. For what values of m can the expression

$$2x^2 + mxy + 3y^2 - 5y - 2$$

be expressed as the product of two linear factors?

(a) 0 (b) ± 1
(c) ± 7 (d) 49

10. If B is a non-singular matrix and A is a square matrix, then $\det(B^{-1}AB)$ is equal to

(a) $\det(A^{-1})$ (b) $\det(B^{-1})$
(c) $\det(A)$ (d) $\det(B)$

11. 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) atmost 3

12. The chances of defective screws in three boxes A, B, C are $\frac{1}{5}, \frac{1}{6}, \frac{1}{7}$ respectively. A box is selected at random and a screw drawn from it at random is found to be defective. Then, the probability that it came from box A, is

(a) $\frac{16}{29}$ (b) $\frac{1}{15}$
(c) $\frac{27}{59}$ (d) $\frac{42}{107}$

13. The value of $\frac{\cos\theta}{1 + \sin\theta}$ is equal to

(a) $\tan\left(\frac{\theta}{2} - \frac{\pi}{4}\right)$ (b) $\tan\left(-\frac{\pi}{4} - \frac{\theta}{2}\right)$
(c) $\tan\left(\frac{\pi}{4} - \frac{\theta}{2}\right)$ (d) $\tan\left(\frac{\pi}{4} + \frac{\theta}{2}\right)$

14. If $3\sin\theta + 5\cos\theta = 5$, then the value of $5\sin\theta - 3\cos\theta$ is equal to

(a) 5 (b) 3
(c) 4 (d) None of these

15. The principal value of $\sin^{-1}\left\{\sin\frac{5\pi}{6}\right\}$ is

(a) $\frac{\pi}{6}$ (b) $\frac{5\pi}{6}$
(c) $\frac{7\pi}{6}$ (d) None of these

16. A rod of length l slides with its ends on two perpendicular lines. Then, the locus of its mid point is

(a) $x^2 + y^2 = \frac{l^2}{4}$ (b) $x^2 + y^2 = \frac{l^2}{2}$
(c) $x^2 - y^2 = \frac{l^2}{4}$ (d) None of these

17. The equation of straight line through the intersection of line $2x + y = 1$ and $3x + 2y = 5$ and passing through the origin is

(a) $7x + 3y = 0$ (b) $7x - y = 0$
(c) $3x + 2y = 0$ (d) $x + y = 0$

18. The line joining $(5, 0)$ to $(10\cos\theta, 10\sin\theta)$ is divided internally in the ratio $2:3$ at P. If θ varies, then the locus of P is

(a) a straight line
(b) a pair of straight lines
(c) a circle
(d) None of the above

19. If $2x + y + k = 0$ is a normal to the parabola $y^2 = -8x$, then the value of k, is

(a) 8 (b) 16
(c) 24 (d) 32

20. $\lim_{n \to \infty} \left[\frac{1}{1 \cdot 2} + \frac{1}{2 \cdot 3} + \frac{1}{3 \cdot 4} + \ldots + \frac{1}{n(n+1)}\right]$ is equal to

(a) 1 (b) -1
(c) 0 (d) None of these

21. The condition that the line $lx + my = 1$ may be normal to the curve $y^2 = 4ax$, is

(a) $al^3 - 2alm^2 = m^2$
(b) $al^2 + 2alm^3 = m^2$
(c) $al^3 + 2alm^2 = m^3$
(d) $al^3 + 2alm^2 = m^2$

22. If $\int f(x)\,dx = f(x)$, then $\int \{f(x)\}^2 dx$ is equal to

(a) $\frac{1}{2}\{f(x)\}^2$ (b) $\{f(x)\}^3$

(c) $\frac{\{f(x)\}^3}{3}$ (d) $\{f(x)\}^2$

23. $\int \sin^{-1}\left\{\frac{(2x+2)}{\sqrt{4x^2+8x+13}}\right\} dx$ is equal to

(a) $(x+1)\tan^{-1}\left(\frac{2x+2}{3}\right) - \frac{3}{4}\log\left(\frac{4x^2+8x+13}{9}\right)+c$

(b) $\frac{3}{2}\tan^{-1}\left(\frac{2x+2}{3}\right) - \frac{3}{4}\log\left(\frac{4x^2+8x+13}{9}\right)+c$

(c) $(x+1)\tan^{-1}\left(\frac{2x+2}{3}\right) - \frac{3}{2}\log(4x^2+8x+13)+c$

(d) $\frac{3}{2}(x+1)\tan^{-1}\left(\frac{2x+2}{3}\right) - \frac{3}{4}\log(4x^2+8x+13)+c$

24. If the equation of an ellipse is $3x^2+2y^2+6x-8y+5=0$, then which of the following are true?

(a) $e = \frac{1}{\sqrt{3}}$

(b) centre is $(-1, 2)$

(c) foci are $(-1, 1)$ are $(-1, 3)$

(d) All of the above

25. The equation of the common tangents to the two hyperbolas $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ and $\frac{y^2}{a^2}-\frac{x^2}{b^2}=1$, are

(a) $y = \pm x \pm \sqrt{b^2-a^2}$

(b) $y = \pm x \pm \sqrt{a^2-b^2}$

(c) $y = \pm x \pm \sqrt{a^2+b^2}$

(d) $y = \pm x \pm (a^2-b^2)$

26. Domain of the function $f(x) = \log_x \cos x$, is

(a) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)-\{1\}$ (b) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]-\{1\}$

(c) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ (d) None of these

27. Range of the function $y = \sin^{-1}\left(\frac{x^2}{1+x^2}\right)$, is

(a) $\left(0, \frac{\pi}{2}\right)$ (b) $\left[0, \frac{\pi}{2}\right)$

(c) $\left(0, \frac{\pi}{2}\right]$ (d) $\left[0, \frac{\pi}{2}\right]$

28. If $x = \sec\theta - \cos\theta$, $y = \sec^n\theta - \cos^n\theta$, then $(x^2+4)\left(\frac{dy}{dx}\right)^2$ is equal to

(a) $n^2(y^2-4)$ (b) $n^2(4-y^2)$

(c) $n^2(y^2+4)$ (d) None of these

29. If $y = \sqrt{x+\sqrt{y+\sqrt{x+\sqrt{y+\ldots\infty}}}}$, then $\frac{dy}{dx}$ is equal to

(a) $\frac{y+x}{y^2-2x}$ (b) $\frac{y^3-x}{2y^2-2xy-1}$

(c) $\frac{y^3+x}{2y^2-x}$ (d) None of these

30. If $\int_1^x \frac{dt}{|t|\sqrt{t^2-1}} = \frac{\pi}{6}$, then x can be equal to

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

(c) 2 (d) None of these

31. The area bounded by the curve $y = |\sin x|$, x-axis and the lines $|x| = \pi$, is

(a) 2 sq unit (b) 1 sq unit

(c) 4 sq unit (d) None of these

32. The degree of the differential equation of all curves having normal of constant length c is

(a) 1 (b) 3

(c) 4 (d) None of these

33. If $\vec{\mathbf{a}} = 2\hat{\mathbf{i}}+2\hat{\mathbf{j}}+3\hat{\mathbf{k}}$, $\vec{\mathbf{b}} = -\hat{\mathbf{i}}+2\hat{\mathbf{j}}+\hat{\mathbf{k}}$ and $\vec{\mathbf{c}} = 3\hat{\mathbf{i}}+\hat{\mathbf{j}}$, then $\vec{\mathbf{a}}+t\,\vec{\mathbf{b}}$ is perpendicular to $\vec{\mathbf{c}}$, if t is equal to

(a) 2 (b) 4

(c) 6 (d) 8

34. The distance between the line $\vec{\mathbf{r}} = 2\hat{\mathbf{i}} - 2\hat{\mathbf{j}} + 3\hat{\mathbf{k}} + \lambda(\hat{\mathbf{i}} - \hat{\mathbf{j}} + 4\hat{\mathbf{k}})$ and the plane $\vec{\mathbf{r}} \cdot (\hat{\mathbf{i}} + 5\hat{\mathbf{j}} + \hat{\mathbf{k}}) = 5$, is

(a) $\frac{10}{3}$ (b) $\frac{10}{\sqrt{3}}$

(c) $\frac{10}{3\sqrt{3}}$ (d) $\frac{10}{9}$

35. The equation of sphere concentric with the sphere $x^2 + y^2 + z^2 - 4x - 6y - 8z - 5 = 0$ and which passes through the origin, is

(a) $x^2 + y^2 + z^2 - 4x - 6y - 8z = 0$

(b) $x^2 + y^2 + z^2 - 6y - 8z = 0$

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

(d) $x^2 + y^2 + z^2 - 4x - 6y - 8z - 6 = 0$

36. If the lines $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$ and $\frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1}$ intersect, then the value of k, is

(a) $\frac{3}{2}$ (b) $\frac{9}{2}$

(c) $-\frac{2}{9}$ (d) $-\frac{3}{2}$

37. The two curves $y = 3^x$ and $y = 5^x$ intersect at an angle

(a) $\tan^{-1}\left(\frac{\log 3 - \log 5}{1 + \log 3 \log 5}\right)$

(b) $\tan^{-1}\left(\frac{\log 3 + \log 5}{1 - \log 3 \log 5}\right)$

(c) $\tan^{-1}\left(\frac{\log 3 + \log 5}{1 + \log 3 \log 5}\right)$

(d) $\tan^{-1}\left(\frac{\log 3 - \log 5}{1 - \log 3 \log 5}\right)$

38. The equation

$$\lambda x^2 + 4xy + y^2 + \lambda x + 3y + 2 = 0$$

represents a parabola, if λ is

(a) 0 (b) 1

(c) 2 (d) 4

39. If two circles $2x^2 + 2y^2 - 3x + 6y + k = 0$ and $x^2 + y^2 - 4x + 10y + 16 = 0$ cut orthogonally, then the value of k is

(a) 41 (b) 14

(c) 4 (d) 1

40. If $A(-2, 1)$, $B(2, 3)$ and $C(-2, -4)$ are three points. Then, the angle between BA and BC is

(a) $\tan^{-1}\left(\frac{2}{3}\right)$ (b) $\tan^{-1}\left(\frac{3}{2}\right)$

(c) $\tan^{-1}\left(\frac{1}{3}\right)$ (d) $\tan^{-1}\left(\frac{1}{2}\right)$

Answer Key

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