1. The eccentricity of the ellipse $9x^2 + 5y^2 - 30y = 0$ is :
   (a) 1/3 (b) 2/3
   (c) 3/4 (d) none of these

2. The maximum value of $12 \sin \theta - 9 \sin^2 \theta$ is :
   (a) 3 (b) 4
   (c) 5 (d) none of these

3. If $\cos 20° = k$ and $\cos x = 2k^2 - 1$, then the possible values of x between 0° and 360° are :
   (a) 140° and 270° (b) 40° and 140°
   (c) 40° and 320° (d) 50° and 130°

4. $\int 5^{5^{5^x}} \cdot 5^{5^x} \cdot 5^x \, dx$ is equal to :
   (a) $\frac{5^{5^{5^x}}}{(\log 5)^3} + c$ (b) $5^{5^{5^x}} (\log 5)^3 + c$
   (c) $\frac{5^{5^{5^x}}}{(\log 5)^3} + c$ (d) none of these

5. If $\cos(\theta + \phi) = m \cos(\theta - \phi)$, then $\tan \theta$ is equal to :
   (a) $[(1 + m)/(1 - m)] \tan \phi$
   (b) $[(1 - m)/(1 + m)] \tan \phi$
   (c) $[(1 - m)/(1 + m)] \cot \phi$
   (d) $[(1 + m)/(1 - m)] \sec \phi$

6. The value of $\lim_{x \to \infty} \frac{\sqrt{1 + x^4} - (1 + x^2)}{x^2}$ is equal to :
   (a) 0 (b) −1
   (c) 2 (d) none of these

7. The roots of the equation $|x^2 - x - 6| = x + 2$ are :
   (a) −2, 1, 4 (b) 0, 2, 4
   (c) 0, 1, 4 (d) −2, 2, 4

8. The maximum number of real roots of the equation $x^{2n} - 1 = 0$ is :
   (a) 2 (b) 3
   (c) n (d) $2n$

9. If α, β, γ are the angles when a directed line makes with the positive directions the coordinate axes, then $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma$ is equal to :
   (a) 1 (b) 2
   (c) 3 (d) none of these

10. The first and last terms of an AP are a and l respectively. If S be the sum of all the terms of the AP, then common difference is :
   (a) $\frac{l^2 - a^2}{2S - (l + a)}$ (b) $\frac{l^2 - a^2}{2S - (l - a)}$
   (c) $\frac{l^2 + a^2}{2S + (l + a)}$ (d) $\frac{l^2 + a^2}{2S - (l + a)}$

11. If the two lines of regression are $x + 4y = 3$ and $3x + y = 5$, then value of x for $y = 3$ is :
   (a) $\frac{2}{3}$ (b) −9
   (c) −4 (d) none of these

12. The value of the following determinant
$$\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix}$$ is :
   (a) $(a - b)(b - c)(c - a)(a + b + c)$
   (b) $abc(a + b)(b + c)(c + a)$
   (c) $(a - b)(b - c)(c - a)$
   (d) none of the above

13. If $A = \begin{bmatrix} 1 & 3 \\ 3 & 10 \end{bmatrix}$, then adjoint of A is :
   (a) $\begin{bmatrix} 10 & 3 \\ 3 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 10 & -3 \\ -3 & 1 \end{bmatrix}$
   (c) $\begin{bmatrix} 1 & 3 \\ 3 & 10 \end{bmatrix}$ (d) $\begin{bmatrix} -1 & -3 \\ -3 & 10 \end{bmatrix}$

14. If $y = 1 + x + x^2 + x^3 + \ldots$, then x is equal to :
   (a) $\frac{y - 1}{y}$ (b) $\frac{1 - y}{y}$
   (c) $\frac{y}{1 - y}$ (d) none of these

15. $1 + \frac{3}{2} + \frac{5}{2^2} + \frac{7}{2^3} + \ldots \infty$ is equal to :
   (a) 2 (b) 6
   (c) 5 (d) none of these

16. If a_r is the coefficient of x^r in the expansion of $(1 + x + x^2)^n$, then $a_1 - 2a_2 + 3a_3 - \ldots - 2na_{2n}$ is equal to :
   (a) 0 (b) n
   (c) $-n$ (d) $2n$

17. $\lim_{x \to 0} \frac{e^{1/x}}{e^{1/x} + 1}$ is equal to :
   (a) 0 (b) 1
   (c) does not exist (d) none of these

18. If P is any point on the ellipse $81x^2 + 144y^2 = 1944$ whose foci are S and S'. Then $SP + S'P$ equals :

(a) 3 (b) $4\sqrt{6}$
(c) 36 (d) 324

19. $\lim_{x \to 0} \frac{2\sin^2 3x}{x^2}$ is equal to :

(a) 0 (b) 1
(c) 18 (d) 36

20. The solution of $\frac{dy}{dx} + \sqrt{\left(\frac{1-y^2}{1-x^2}\right)} = 0$ is :

(a) $\tan^{-1} x + \cot^{-1} x = c$
(b) $\sin^{-1} x + \sin^{-1} y = c$
(c) $\sec^{-1} x + \operatorname{cosec}^{-1} x = c$
(d) none of the above

21. If $x = a(\cos\theta + \theta \sin\theta)$ and $y = a(\sin\theta - \theta\cos\theta)$, then $\frac{dy}{dx}$ is equal to :

(a) $\cos\theta$ (b) $\tan\theta$
(c) $\sec\theta$ (d) $\operatorname{cosec}\theta$

22. $\int_1^x \frac{\log(x^2)}{x} dx$ is equal to :

(a) $(\log x)^2$ (b) $\frac{1}{2}(\log x)^2$
(c) $\frac{\log x^2}{2}$ (d) none of these

23. The two regression lines are $2x - 7y + 6 = 0$ and $7x - 2y + 1 = 0$. The correlation coefficient between x and y is :

(a) $-\frac{2}{3}$ (b) $\frac{2}{7}$
(c) $\frac{4}{9}$ (d) none of these

24. Simpson's one third rule for evolution $\int_a^b f(x)dx$ requires the interval $[a, b]$ to be divided into :

(a) an even number of sub-intervals of equal width
(b) any number of sub-intervals
(c) any number of sub-intervals of equal width
(d) an odd number of sub-intervals of equal width

25. If $\sin A = \sin B$ and $\cos A = \cos B$, then A is equal to :

(a) $2n\pi + B$ (b) $2n\pi - B$
(c) $n\pi + B$ (d) $n\pi + (-1)^n B$

26. The number of diagonals that can be drawn in a polygon of 15 sides, is :

(a) 16 (b) 60
(c) 90 (d) 80

27. $\tan 10° + \tan 35° + \tan 10° \tan 35°$ is equal to :

(a) 0 (b) $\frac{1}{2}$
(c) -1 (d) 1

28. If $\begin{vmatrix} a+b & b+c & c+a \\ b+c & c+a & a+b \\ c+a & a+b & b+c \end{vmatrix} = k \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$, then k is equal to :

(a) 1 (b) 2
(c) 3 (d) 8

29. If a, b, c are in AP, then $2^{ax+1}, 2^{bx+1}, 2^{cx+1}, x \neq 0$ are in :

(a) AP
(b) GP only when $x > 0$
(c) GP if $x < 0$
(d) GP

30. If α and β are the roots of the equation $ax^2 + bx + c = 0$, then

$(1 + \alpha + \alpha^2)(1 + \beta + \beta^2)$ is equal to :

(a) 0 (b) positive
(c) negative (d) none of these

31. The angle between the tangents drawn from the origin to the circle $(x-7)^2 + (y+1)^2 = 25$ is :

(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{6}$
(c) $\frac{\pi}{2}$ (d) $\frac{\pi}{8}$

32. The area of the circle whose centre is at (1, 2) and passing through (4, 6) is :

(a) 5π sq unit (b) 10π sq unit
(c) 25π sq unit (d) none of these

33. The curve represented by $x = 3(\cos t + \sin t)$, $y = 4(\cos t - \sin t)$ is :

(a) ellipse (b) parabola
(c) hyperbola (d) circle

34. The line $y = mx + 1$ is a tangent to the parabola $y^2 = 4x$, if :

(a) $m = 1$ (b) $m = 2$
(c) $m = 4$ (d) $m = 3$

35. $f(x) = \begin{vmatrix} x^3 & x^4 & 3x^2 \\ 1 & -6 & 4 \\ p & p^2 & p^3 \end{vmatrix}$, here p is a constant, then $\frac{d^3 f(x)}{dx^3}$ is :

(a) proportional to x^2
(b) proportional to x
(c) proportional to x^3
(d) a constant

36. $\int_0^{1.5} [x^2]\,dx$ is :

(a) $4 + 2\sqrt{2}$ (b) $2 + \sqrt{2}$
(c) $2 - \sqrt{2}$ (d) none of these

37. The rational number which is equal to the number $2.\dot{3}\dot{5}\dot{7}$ with recurring decimal is :

(a) $\frac{2355}{1001}$ (b) $\frac{2370}{997}$
(c) $\frac{2355}{999}$ (d) none of these

38. The differential coefficient of $f(\log x)$ w.r.t. x, where $f(x) = \log x$ is :

(a) $\frac{x}{\log x}$ (b) $\frac{\log x}{x}$
(c) $(x \log x)^{-1}$ (d) none of these

39. There are six vertices of a regular hexagon are chosen at random, then the possibility that the triangle with three vertices is equilateral, is equal to :

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$
(c) $\frac{1}{10}$ (d) $\frac{1}{20}$

40. The number of vectors of unit length perpendicular to the two vectors $a = (1, 1, 0)$ and $b = (0, 1, 1)$ is :

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

41. Three identical dice are rolled. The probability that same number will appear on each of them will be :

(a) $\frac{1}{6}$ (b) $\frac{1}{36}$
(c) $\frac{1}{18}$ (d) $\frac{3}{28}$

42. If sets A and B are defined as $A = \{(x, y) : y = e^x, x \in R\}$ and $B = \{(x, y) : y = x, x \in R\}$ then

(a) $B \subset A$ (b) $A \subset B$
(c) $A \cap B = \phi$ (d) $A \cup B = A$

43. Given $A = \sin^2\theta + \cos^4\theta$, then for all real value of θ :

(a) $1 \le A \le 2$ (b) $\frac{3}{4} \le A \le 1$
(c) $\frac{13}{16} \le A < 1$ (d) $\frac{3}{4} \le A \le \frac{13}{16}$

44. If the vectors

$$a\hat{i} + \hat{j} + \hat{k}, \hat{i} + b\hat{j} + \hat{k}, \hat{i} + \hat{j} + c\hat{k}$$

$(a \ne 1, b \ne 1, c \ne 1)$ are coplanar, then the value of $\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c}$ is :

(a) 0 (b) 1
(c) −1 (d) 2

45. A lady gives a dinner party for six guest. The number of ways in which they may be selected from among ten friends, if two of the friends will not attends the party together, is :

(a) 112 (b) 140
(c) 164 (d) none of these

46. Remainder of $x^{64} + x^{27} + 1$ divided by $x + 1$ is :

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

47. If the imaginary part of $\frac{2z+1}{iz+1}$ is -2, then the locus of the point represented by z is a :

(a) circle (b) straight line
(c) parabola (d) none of these

48. If z_1, z_2, z_3 are in AP (z_1, z_2, z_3 are complex numbers), then they lies on a :

(a) circle (b) straight line
(c) parabola (d) none of these

49. Area of the region bounded by the curve $y = \tan x$, tangent drawn to the curve at $x = \frac{\pi}{4}$ and the x-axis is :

(a) $\log\sqrt{2}$ sq unit
(b) $\left(\log\sqrt{2} + \frac{1}{4}\right)$ sq unit
(c) $\left(\log\sqrt{2} - \frac{1}{4}\right)$ sq unit
(d) $\frac{1}{4}$ sq unit

50. The number of values of x in the interval $[0, 2\pi]$, where the function $f(x) = \cos x + \cos\sqrt{2}x$ attains its maximum, is :

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