

- The area bounded by the curve $y = 2x - x^2$ and the line $y = -2$ is given by
 (A) $\frac{32}{3}$ (B) 3 (C) $\frac{16}{3}$ (D) none of these
- The value of the integral $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} 2 \sin^2 x \, dx$ is
 (A) 0 (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{2}$ (D) π
- $\int \frac{dx}{x^2+36}$ is equal to
 (A) $\frac{1}{6} \cot^{-1} \frac{x}{6} + c$ (B) $\frac{1}{6} \tan^{-1} \frac{x}{6} + c$ (C) $\frac{1}{6} \sin^{-1} \frac{x}{6} + c$ (D) none of these
- $\int \cos x \cdot \ln \tan \frac{x}{2} \, dx$ is equal to
 (A) $\sin x \cdot \ln \tan \frac{x}{2} + x + c$ (B) $\sin x \cdot \ln \tan \frac{x}{2} - x + c$
 (C) $-\sin x \cdot \ln \tan \frac{x}{2} - 1 + c$ (D) none of these
- The value of the integral $\frac{1}{2} \int_0^{\frac{\pi}{2}} \frac{1+2 \cos x}{(2+\cos x)^2} \, dx$ is
 (A) $\frac{1}{8}$ (B) $-\frac{1}{8}$ (C) $-\frac{1}{4}$ (D) $\frac{1}{4}$
- $\int_0^1 \frac{\tan^{-1} x}{1+x^2} \, dx$ is equal to
 (A) $\frac{\pi}{4}$ (B) $\frac{\pi^2}{32}$ (C) 1 (D) none of these
- The solution of the differential equation $\frac{d^2 y}{dx^2} = 6x - 4$ satisfying $y(0) = 1, y'(0) = 1$ is
 (A) $y = x^3 - 2x^2 + 1$ (B) $y = 1 - x^3 + 2x^2$
 (C) $y = x^3 + 2x^2 - x$ (D) $y = x^3 - 2x^2 + x$
- A differential equation which represents the family of curves $y = e^{\alpha x}$ is
 (A) $y' = \alpha y$ (B) $xy' - \ln y = 0$ (C) $x \ln y = y y'$ (D) $y \ln y = x y'$
- The order and degree of the differential equation $\frac{d^2 y}{dx^2} = \left\{ y + \left(\frac{dy}{dx} \right)^2 \right\}^{\frac{1}{3}}$ is
 (A) 3,2 (B) 1,2 (C) 1,3 (D) 2,3
- The solution of the differential equation $\frac{dy}{dx} = \frac{y-x}{y+x}$ is
 (A) $\ln \left(\frac{x^2+y^2}{x^2} \right) + 2 \tan^{-1} \frac{y}{x} = c$ (B) $\frac{y^2}{2} + xy = \frac{x^3-x^2}{2} + c$
 (C) $\left(1 + \frac{x}{y} \right) y = \left(1 - \frac{x}{y} \right) + c$ (D) $y = x - 2 \ln y + c$
- Solution of the differential equation $\frac{dy}{dx} + 2y = e^x$ is
 (A) $3y = e^x + c$ (B) $ye^{2x} = e^x + c$ (C) $y = e^x + ce^{-2x}$ (D) $3y = e^x + ce^{-2x}$

12. The variance of first 20 natural numbers is
(A) $\frac{401}{12}$ (B) $\frac{399}{12}$ (C) $\frac{287}{2}$ (D) none of these
13. 5 boys and 5 girls sit in a row randomly. Then the probability that all 5 girls sit together is
(A) $\frac{1}{32}$ (B) $\frac{1}{4}$ (C) $\frac{1}{42}$ (D) none of these
14. A bag contains 8 white and 6 red balls. Then the probability of drawing two balls of the same colour is
(A) $\frac{28}{91}$ (B) $\frac{15}{91}$ (C) $\frac{43}{91}$ (D) none of these
15. $\lim_{x \rightarrow 0} (\sin x + \cos x)^{\frac{1}{x}}$ is equal to
(A) e (B) e^2 (C) $\frac{1}{e}$ (D) 1
16. $\lim_{x \rightarrow 1} \frac{x^{20} - 1}{x - 1}$ is equal to
(A) 0 (B) 10 (C) 20 (D) none of these
17. The value of 'a' for which the function $f(x) = \begin{cases} ax - 1, & x < 2 \\ 2x - 3, & x \geq 2 \end{cases}$ is continuous at $x = 2$ is
(A) 0 (B) 2 (C) 1 (D) 4
18. A function f is defined by $f(x) = 2e^x \sin x$ in $[0, \pi]$, then which of the following is not Correct?
(A) f is continuous in $[0, \pi]$
(B) f is differentiable in $[0, \pi]$
(C) $f(0) = f(\pi)$
(D) Rolle's theorem is not true in $[0, \pi]$
19. If $f(x) = 2x|x|$, then $f(x)$ is
(A) continuous as well as differentiable in $[-1, 1]$
(B) continuous but not differentiable in $[-1, 1]$
(C) differentiable but not continuous in $[-1, 1]$
(D) none of these
20. If $x = y\sqrt{1 - x^2}$, then $\frac{dy}{dx}$ is equal to
(A) y (B) $\frac{\sqrt{1 - x^2}}{1 + 2x^2}$ (C) $\frac{\sqrt{1 - y^2}}{1 - 2y^2}$ (D) 0

21. If $y = \ln \ln x$, then $e^y \frac{dy}{dx}$ is equal to
 (A) $\frac{1}{x \ln x}$ (B) $\ln x$ (C) $\frac{1}{\ln x}$ (D) $\frac{1}{x}$
22. The equation of the tangent at the point (1,1) to the curve $2y = 4 - x^2$ is
 (A) $x + y = 0$ (B) $x + y + 1 = 0$ (C) $x - y + 1 = 0$ (D) $x + y = 2$
23. The maximum value of $2x^3 + 3x^2 - 12x + 4$ for $-3 \leq x < 4$ occurs at $x =$
 (A) 2 (B) 4 (C) 1 (D) -2
24. If $z = \sin^{-1} \frac{x}{y} + \tan^{-1} \frac{y}{x}$, then $x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y}$ is equal to
 (A) $\sin z$ (B) $\tan z$ (C) 0 (D) none of these
25. If $y = (2x + 3)^9$, then $y^{(5)}$ ($y^{(n)}$ denotes the n -th order derivative) is equal to
 (A) $9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \times 2^5 (2x + 3)^5$ (B) $9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \times 2^5 (2x + 3)^4$
 (C) $9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \times 2^4 (2x + 3)^5$ (D) $9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \times 2^4 (2x + 3)^4$
26. The sum of the series $1 + 3x + 6x^2 + 10x^3 + \dots \infty$ is (here $|x| < 1$)
 (A) $\frac{1}{(1-x)^2}$ (B) $\frac{1}{1-x}$ (C) $\frac{1}{(1+x)^2}$ (D) $\frac{1}{(1-x)^3}$
27. If $\vec{a}$ and $\vec{b}$ are unit vectors and θ is the angle between them, the $\frac{1}{2} |\vec{a} - \vec{b}|$ is equal to
 (A) $\frac{1}{2} |\sin \frac{\theta}{2}|$ (B) $|\sin \frac{\theta}{2}|$ (C) $2 |\sin \frac{\theta}{2}|$ (D) none of these
28. If $\vec{a}, \vec{b}$ and $\vec{c}$ are any three vectors, then $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \times \vec{b}) \times \vec{c}$ only if
 (A) $\vec{b}$ and $\vec{c}$ are collinear (B) $\vec{a}$ and $\vec{c}$ are collinear
 (C) $\vec{a}$ and $\vec{b}$ are collinear (D) none of these
29. If $2x^2 + 3x - 2 \leq 0$, then
 (A) $x \leq -2$ (B) $-2 \leq x \leq \frac{1}{2}$ (C) $x \geq -2$ (D) $x \leq \frac{1}{2}$
30. The smallest value of $x^2 - 3x + 3$ in $(-3, 3)$ is
 (A) -18 (B) -14 (C) $\frac{3}{4}$ (D) none of these
31. The direction cosines of any normal to the xy -plane are
 (A) 1,0,0 (B) 0,1,0 (C) 1,1,0 (D) 0,0,1
32. The distance of the point (1,3,-2) from the plane $x + y - z = 5$ measured parallel to the line $\frac{x}{2} = \frac{y}{3} = \frac{z-1}{-6}$ is

- (A) $\frac{5}{11}$ (B) $\frac{3}{11}$ (C) $\frac{7}{11}$ (D) none of these
33. The shortest distance from the plane $12x + 4y + 3z = 327$ to the sphere $x^2 + y^2 + z^2 + 4x - 2y - 6z = 155$ is
 (A) 26 (B) 23 (C) 13 (D) none of these
34. If the line $\frac{x-x_1}{l} = \frac{y-y_1}{m} = \frac{z-z_1}{n}$ is parallel to the plane $ax + by + cz + d = 0$, then
 (A) $\frac{a}{l} = \frac{b}{m} = \frac{c}{n}$ (B) $al + bm + cn = 0$
 (C) $\frac{a}{l} + \frac{b}{m} + \frac{c}{n} = 0$ (D) none of these
35. The equation of the straight line passing through the point of intersection of the lines $x - y = 2$ and $2x - 3y + 1 = 0$ and parallel to the line $3x + 4y = 16$ is
 (A) $3x + 4y + 41 = 0$ (B) $3x + 4y - 41 = 0$
 (C) $4x + 3y + 41 = 0$ (D) $4x + 3y - 41 = 0$
36. If the slope of one of the lines given by $ax^2 + 2hxy + by^2 = 0$ be the square of the other, then
 (A) $ab(a + b) + 6abh + 8h^3 = 0$ (B) $ab(a + b) - 6abh + 8h^3 = 0$
 (C) $ab(a + b) + 3abh + 4h^3 = 0$ (D) none of these
37. If $(1, -1)$ lies on the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ which is concentric with the circle $x^2 + y^2 + 4x - 6y + 3 = 0$, then the value of c is
 (A) 12 (B) -12 (C) 14 (D) -14
38. If $(6,0)$ is the vertex and y -axis is the directrix of a parabola, then its focus is
 (A) $(8,0)$ (B) $(4,0)$ (C) $(12,0)$ (D) none of these
39. The eccentricity of the ellipse $9x^2 + 5y^2 - 30y = 0$ is
 (A) $\frac{1}{3}$ (B) $\frac{2}{3}$ (C) $\frac{3}{4}$ (D) none of these
40. An equation of the tangent to the hyperbola $3x^2 + 4y^2 = 3$, which is perpendicular to the line $x + 3y - 7 = 0$ is
 (A) $y = 3x + \sqrt{6}$ (B) $y = -3x + \sqrt{6}$ (C) $y = 3x - 6$ (D) none of these
41. If $\alpha + \beta = 45^\circ$, then $(1 + \tan \alpha)(1 + \tan \beta)$ is equal to
 (A) 1 (B) -1 (C) 2 (D) none of these
42. The most general solution of $\tan \theta = -1$ and $\cos \theta = \frac{1}{\sqrt{2}}$ is
 (A) $n\pi + \frac{7\pi}{4}$ (B) $n\pi + (-1)^n \frac{7\pi}{4}$ (C) $2n\pi + \frac{7\pi}{4}$ (D) none of these
 (here n is an integer)

43. The value of $\sin\left(\frac{\pi}{2} - \sin^{-1}\left(-\frac{1}{2}\right)\right)$ is equal to
 (A) $\frac{\sqrt{3}}{2}$ (B) $-\frac{\sqrt{3}}{2}$ (C) $\frac{1}{2}$ (D) none of these
44. In a triangle ABC if $b + c = 3a$, then $\tan\frac{B}{2} \tan\frac{C}{2}$ is equal to
 (A) $\frac{1}{3}$ (B) 1 (C) $\frac{1}{4}$ (D) $\frac{1}{2}$
45. If $\alpha + \beta + \gamma = \frac{\pi}{2}$, then the value of $\tan \alpha \tan \beta + \tan \beta \tan \gamma + \tan \gamma \tan \alpha$ will be
 (A) 1 (B) $\frac{1}{2}$ (C) $\frac{3}{2}$ (D) none of these
46. The minor of '2' in the determinant $\begin{vmatrix} 1 & 2 & 0 \\ 3 & -1 & 4 \\ -2 & 0 & 3 \end{vmatrix}$ is
 (A) 0 (B) 17 (C) -17 (D) -15
47. If the value of a third order determinant is 8, then the value of the determinant formed by its cofactor is
 (A) 8 (B) 24 (C) 32 (D) 64
48. The value of the determinant $\begin{vmatrix} 2 & 3 & 5 \\ 4 & 6 & 9 \\ 8 & 11 & 15 \end{vmatrix}$ is
 (A) -2 (B) 2 (C) 4 (D) -4
49. The system of linear equations $x + y + z = 2$, $2x + y - z = 3$, $3x + 2y + kz = 4$ has a unique solution if
 (A) $k \neq 0$ (B) $-1 < k < 1$ (C) $-2 < k < 2$ (D) $k = 0$
50. Let z be a complex number with modules 4 and argument $\frac{2\pi}{3}$, then z is equal to
 (A) $-2 + i2\sqrt{3}$ (B) $2 - i2\sqrt{3}$ (C) $-1 + i\sqrt{3}$ (D) none of these
51. If $\left(\frac{1+\cos\theta+i\sin\theta}{\sin\theta+i\cos\theta}\right)^n = \cos(n\theta) + i\sin(n\theta)$, then n is equal to
 (A) 2 (B) 3 (C) 4 (D) none of these
52. If the geometric mean between two non-negative numbers a and b be same as the harmonic mean, then $2\frac{a}{b}$ is equal to
 (A) 2 (B) 1 (C) $\frac{1}{2}$ (D) none of these
53. The number of ways in which 5 letters can be posted in 6 letter boxes in a town is
 (A) 6^5 (B) 5^6 (C) 6P_5 (D) 6C_5
54. The number of proper divisors (excluding 1, and itself) of 252 is
 (A) 46 (B) 47 (C) 56 (D) none of these

55. If $(1+x)^n = C_0 + C_1x + C_2x^2 + \dots + C_nx^n$, then $C_0 + \frac{C_1}{2} + \frac{C_2}{3} + \dots + \frac{C_{10}}{11}$ is equal to
(A) 2^{11} (B) $\frac{2^{11}-1}{11}$ (C) $\frac{2^{11}}{11}$ (D) none of these
56. If the set A has 4 elements, B has 5 elements, then the number of elements in $A \times B$ is
(A) 10 (B) 20 (C) 16 (D) 9
57. Let R be a relation on the set of natural numbers $\mathbb{N}$ such that mRn if m is a factor of n , (here m, n are elements of $\mathbb{N}$) then the relation is
(A) reflexive and symmetric
(B) reflexive and transitive
(C) equivalence relation
(D) transitive but not reflexive
58. Let $f: (0, \infty) \rightarrow (0, \infty)$ be defined by $f(x) = 10x^2$, $x \in (0, \infty)$, then f is
(A) one to one but not onto
(B) onto but not one-to-one
(C) bijective
(D) neither one-to-one nor onto
59. Which of the following is a statement
(A) shut the door
(B) listen to me
(C) is $9 \times 3 = 27$?
(D) 15 is less than 3
60. The binary representation of 13 is
(A) 1001 (B) 1101 (C) 1011 (D) 1110