1. 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

2. 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

3. $\int \frac{dx}{x^2+36}$ 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

4. $\int \cos x . \ln \tan\frac{x}{2} dx$ is equal to

(A) $\sin x . \ln\tan\frac{x}{2} + x + c$ (B) $\sin x . \ln\tan\frac{x}{2} - x + c$

(C) $-\sin x . \ln\tan\frac{x}{2} - 1 + c$ (D) none of these

5. The value of the integral $\frac{1}{2}\int_0^{\frac{\pi}{2}} \frac{1+2\cos x}{(2+\cos x)^2}$ is

(A) $\frac{1}{8}$ (B) $-\frac{1}{8}$ (C) $-\frac{1}{4}$ (D) $\frac{1}{4}$

6. $\int_0^1 \frac{\tan^{-1} x}{1+x^2} dx$ is equal to

(A) $\frac{\pi}{4}$ (B) $\frac{\pi^2}{32}$ (C) 1 (D) none of these

7. The solution of the differential equation $\frac{d^2y}{dx^2} = 6x - 4$ 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) $y = x^3 - 2x^2 + x$

8 . 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) $y \ln y = x\, y'$

9. The order and degree of the differential equation $\frac{d^2y}{dx^2} = \left\{y + \left(\frac{dy}{dx}\right)^2\right\}^{\frac{1}{3}}$ is

(A) 3,2 (B) 1,2 (C) 1,3 (D) 2,3

10. 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) $y = x - 2\ln y + c$

11. 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. $\lim_{x\to 0}(\sin x + \cos x)^{\frac{1}{x}}$ is equal to

(A) e (B) e^2 (C) $\frac{1}{e}$ (D) 1

16. $\lim_{x\to 1}\frac{x^{20}-1}{x-1}$ 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 $-3 \le x < 4$ occurs at $x =$

(A) 2 (B) 4 C) 1 (D) -2

24. If $= \sin^{-1}\frac{x}{y} + \tan^{-1}\frac{y}{x}$, 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) $9.8.7.6.5 \times 2^5(2x+3)^5$ (B) $9.8.7.6.5 \times 2^5(2x+3)^4$

(C) $9.8.7.6.5 \times 2^4(2x+3)^5$ (D) $9.8.7.6.5 \times 2^4(2x+3)^4$

26. The sum of the series $1 + 3x + 6x^2 + 10x^2 + \cdots \infty$ 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) $\frac{1}{2}\left|\sin\frac{\theta}{2}\right|$ (B) $\left|\sin\frac{\theta}{2}\right|$ (C) $2\left|\sin\frac{\theta}{2}\right|$ (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 $2x^2 + 3x - 2 \le 0$, then

(A) $x \le -2$ (B) $-2 \le x \le \frac{1}{2}$ (C) $x \ge -2$ (D) $x \le \frac{1}{2}$

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 $\left(\frac{1+\cos\theta+i\sin\theta}{\sin\theta+i+i\cos\theta}\right)^n = \cos(n\theta) + i\sin(n\theta)$, 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 $(1+x)^n = C_0 + C_1x + C_2x^2 + \cdots + C_nx^n$, then $C_0 + \frac{C_1}{2} + \frac{C_2}{3} + \cdots \frac{C_{10}}{11}$ 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 , 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 $(x) = 10x^2$, $x \in (0, \infty)$, 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