1. $\cot^{-1}\left[\dfrac{\sqrt{1-\sin x}+\sqrt{1+\sin x}}{\sqrt{1-\sin x}-\sqrt{1+\sin x}}\right]=$

(a) $\pi - x$ (b) $2\pi - x$

(c) $\dfrac{x}{2}$ (d) $\pi - \dfrac{x}{2}$

2. The principal value of $\sin^{-1}\left[\sin\left(\dfrac{2\pi}{3}\right)\right]$ is

(a) $-\dfrac{2\pi}{3}$ (b) $\dfrac{2\pi}{3}$

(c) $\dfrac{4\pi}{3}$ (d) None of these

3. If $\theta=\tan^{-1}a, \phi=\tan^{-1}b$ and $ab=-1$, then $\theta-\phi=$

(a) 0 (b) $\dfrac{\pi}{4}$

(c) $\dfrac{\pi}{2}$ (d) None of these

4. If the sides of triangle are 13, 14, 15, then the radius of its incircle is

(a) $\dfrac{67}{8}$ (b) $\dfrac{65}{4}$

(c) 4 (d) 24

5. The inradius of the triangle whose sides are 3, 5, 6, is

(a) $\sqrt{8/7}$ (b) $\sqrt{8}$

(c) $\sqrt{7}$ (d) $\sqrt{7/8}$

6. Let z, w be complex numbers such that $\bar{z}+i\bar{w}=0$ and $arg\ zw=\pi$. Then arg z equals

(a) $5\pi/4$ (b) $\pi/2$

(c) $3\pi/4$ (d) $\pi/4$

7. If $(1+x)^n = C_0 + C_1x + C_2x^2 + ... + C_nx^n$, then the value of $C_0 - C_2 + C_4 - C_6 + ...$ is

(a) 2^n (b) $2^n \cos\dfrac{n\pi}{2}$

(c) $2^n \sin\dfrac{n\pi}{2}$ (d) $2^{n/2}\cos\dfrac{n\pi}{4}$

8. If $x=\cos\theta+i\sin\theta$ and $y=\cos\phi+i\sin\phi$, then $x^m y^n + x^{-m}y^{-n}$ is equal to

(a) $\cos(m\theta+n\phi)$ (b) $\cos(m\theta-n\phi)$

(c) $2\cos(m\theta+n\phi)$ (d) $2\cos(m\theta-n\phi)$

9. The value of $\sum_{r=1}^{8}\left(\sin\dfrac{2r\pi}{9}+i\cos\dfrac{2r\pi}{9}\right)$ is

(a) -1 (b) 1

(c) i (d) $-i$

10. If $T_0, T_1, T_2, ...T_n$ represent the terms in the expansion of $(x+a)^n$, then $(T_0 - T_2 + T_4 - ....)^2 + (T_1 - T_3 + T_5 - ....)^2 =$

(a) (x^2+a^2) (b) $(x^2+a^2)^n$

(c) $(x^2+a^2)^{1/n}$ (d) $(x^2+a^2)^{-1/n}$

11. For every positive integer n, $2^n < n!$ when

(a) n < 4 (b) n $\geq$ 4

(c) n < 3 (d) None of these

12. m men and n women are to be seated in a row so that no two women sit together. If $m > n$, then the number of ways in which they can be seated is

(a) $\dfrac{m!\,(m+1)!}{(m-n+1)!}$ (b) $\dfrac{m!\,(m-1)!}{(m-n+1)!}$

(c) $\dfrac{(m-1)!\,(m+1)!}{(m-n+1)!}$ (d) None of these

13. A five digit number divisible by 3 has to formed using the numerals 0, 1, 2, 3, 4 and 5 without repetition. The total number of ways in which this can be done is

(a) 216 (b) 240

(c) 600 (d) 3125

14. The centre of the circle passing through (0, 0) and (1, 0) and touching the circle $x^2+y^2=9$ is

(a) $\left(\dfrac{1}{2},\dfrac{1}{2}\right)$ (b) $\left(\dfrac{1}{2},-\sqrt{2}\right)$

(c) $\left(\dfrac{3}{2},\dfrac{1}{2}\right)$ (d) $\left(\dfrac{1}{2},\dfrac{3}{2}\right)$

15. If $\left(m_i,\dfrac{1}{m_i}\right), i=1,2,3,4$ are con-cyclic points, then the value of $m_1.m_2.m_3.m_4$ is

(a) 1 (b) – 1

(c) 0 (d) None of these

16. The equation of the parabola with its vertex at the origin, axis on the y-axis and passing through the point (6, –3) is

(a) $y^2=12x+6$ (b) $x^2=12y$

(c) $x^2=-12y$ (d) $y^2=-12x+6$

17. Focus and directrix of the parabola $x^2=-8ay$ are

(a) $(0, -2a)$ and $y=2a$ (b) $(0, 2a)$ and $y=-2a$

(c) $(2a, 0)$ and $x=-2a$ (d) $(-2a, 0)$ and $x=2a$

18. A hyperbola passes through the points (3, 2) and (–17, 12) and has its centre at origin and transverse axis is along x-axis. The length of its transverse axis is

(a) 2 (b) 4
(c) 6 (d) None of these

19. The locus of the point of intersection of the lines $\sqrt{3}x - y - 4\sqrt{3}k = 0$ and $\sqrt{3}kx + ky - 4\sqrt{3} = 0$ for different value of k is

(a) Circle (b) Parabola
(c) Hyperbola (d) Ellipse

20. If the centre, one of the foci and semi-major axis of an ellipse be (0, 0), (0, 3) and 5 then its equation is

(a) $\frac{x^2}{16}+\frac{y^2}{25}=1$ (b) $\frac{x^2}{25}+\frac{y^2}{16}=1$
(c) $\frac{x^2}{9}+\frac{y^2}{25}=1$ (d) None of these

21. The equation of the ellipse whose one of the vertices is (0,7) and the corresponding directrix is $y = 12$, is

(a) $95x^2 + 144y^2 = 4655$ (b) $144x^2 + 95y^2 = 4655$
(c) $95x^2 + 144y^2 = 13680$ (d) None of these

22. The derivative of $\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$ with respect to $\tan^{-1}\left(\frac{2x\sqrt{1-x^2}}{1-2x^2}\right)$ at $x = 0$, is

(a) $\frac{1}{8}$ (b) $\frac{1}{4}$
(c) $\frac{1}{2}$ (d) 1

23. If $y^2 = p(x)$ is a polynomial of degree three, then $2\frac{d}{dx}\left\{y^3.\frac{d^2y}{dx^2}\right\} =$

(a) $p'''(x) + p'(x)$ (b) $p''(x).p'''(x)$
(c) $p(x).p'''(x)$ (d) Constant

24. Let $f(x)$ and $g(x)$ be two functions having finite non-zero 3rd order derivatives $f'''(x)$ and $g'''(x)$ for all, $x \in R$. If $f(x)g(x) = 1$ for all $x \in R$, then $\frac{f'''}{f'} - \frac{g'''}{g'}$ is equal to

(a) $3\left(\frac{f''}{g} - \frac{g''}{f}\right)$ (b) $3\left(\frac{f''}{f} - \frac{g''}{g}\right)$
(c) $3\left(\frac{g''}{g} - \frac{f''}{g}\right)$ (d) $3\left(\frac{f''}{f} - \frac{g''}{f}\right)$

25. If $I_n = \frac{d^n}{dx^n}(x^n \log x)$, then $I_n - nI_{n-1} =$

(a) n (b) $n-1$
(c) $n!$ (d) $(n-1)!$

26. If $x = \sin t$ and $y = \sin pt$, then the value of $(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + p^2y$ is equal to

(a) 0 (b) 1
(c) –1 (d) $\sqrt{2}$

27. Let $f:(0,+\infty) \to R$ and $F(x) = \int_0^x f(t)\,dt$.

If $F(x^2) = x^2(1+x)$, then $f(4)$ equals

(a) $\frac{5}{4}$ (b) 7
(c) 4 (d) 2

28. The volume of a spherical balloon is increasing at the rate of 40 cubic centrimetre per minute. The rate of change of the surface of the balloon at the instant when its radius is 8 centimetre, is

(a) $\frac{5}{2}$ sq cm/min (b) 5 sq cm/min
(c) 10 sq cm/min (d) 20 sq cm/min

29. If $\int \frac{dx}{1+\sin x} = \tan\left(\frac{x}{2}+a\right)+b$, then

(a) $a = \frac{\pi}{4}, b = 3$

(b) $a = -\frac{\pi}{4}, b = 3$

(c) $a = \frac{\pi}{4}, b =$ arbitrary constant

(d) $a = -\frac{\pi}{4}, b =$ arbitrary constant

30. $\int \frac{dx}{\sin x + \cos x} =$

(a) $\log\tan\left(\frac{\pi}{8}+\frac{x}{2}\right)+c$ (b) $\log\tan\left(\frac{\pi}{8}-\frac{x}{2}\right)+c$
(c) $\frac{1}{\sqrt{2}}\log\tan\left(\frac{\pi}{8}+\frac{x}{2}\right)+c$ (d) None of these

31. The locus of P such that area of $\Delta PAB = 12 sq.$ units, where $A(2,3)$ and $B(-4,5)$ is

(a) $(x+3y-1)(x+3y-23)=0$
(b) $(x+3y+1)(x+3y-23)=0$
(c) $(3x+y-1)(3x+y-23)=0$
(d) $(3x+y+1)(3x+y+23)=0$

32. The position of a moving point in the XY-plane at time t is given by $\left((u\cos\alpha)t, (u\sin\alpha)t - \frac{1}{2}gt^2\right)$, where u, α, g are constants. The locus of the moving point is

(a) A circle (b) A parabola
(c) An ellipse (d) None of these

33. If $A(\cos\alpha, \sin\alpha), B(\sin\alpha, -\cos\alpha), C(1, 2)$ are the vertices of a ΔABC, then as α varies, the locus of its centroid is

(a) $x^2 + y^2 - 2x - 4y + 1 = 0$
(b) $3(x^2 + y^2) - 2x - 4y + 1 = 0$
(c) $x^2 + y^2 - 2x - 4y + 3 = 0$
(d) None of these

34. The equations of two equal sides of an isosceles triangle are $7x - y + 3 = 0$ and $x + y - 3 = 0$ and the third side passes through the point (1, – 10). The equation of the third side is

(a) $x - 3y - 31 = 0$ but not $3x + y + 7 = 0$
(b) $3x + y + 7 = 0$ but not $x - 3y - 31 = 0$
(c) $3x + y + 7 = 0$ or $x - 3y - 31 = 0$
(d) Neither $3x + y + 7$ nor $x - 3y - 31 = 0$

35. The graph of the function $\cos x \cos(x+2) - \cos^2(x+1)$ is

(a) A straight line passing through $(0, -\sin^2 1)$ with slope 2
(b) A straight line passing through (0, 0)
(c) A parabola with vertex $(1, -\sin^2 1)$
(d) A straight line passing through the point $\left(\frac{\pi}{2}, -\sin^2 1\right)$ and parallel to the x–axis

36. If the equation of base of an equilateral triangle is $2x - y = 1$ and the vertex is (–1, 2), then the length of the side of the triangle is

(a) $\sqrt{\frac{20}{3}}$ (b) $\frac{2}{\sqrt{15}}$
(c) $\sqrt{\frac{8}{15}}$ (d) $\sqrt{\frac{15}{2}}$

37. The general value of θ satisfying the equation $2\sin^2\theta - 3\sin\theta - 2 = 0$ is

(a) $n\pi + (-1)^n \frac{\pi}{6}$ (b) $n\pi + (-1)^n \frac{\pi}{2}$
(c) $n\pi + (-1)^n \frac{5\pi}{6}$ (d) $n\pi + (-1)^n \frac{7\pi}{6}$

38. The general solution of the equation $(\sqrt{3} - 1)\sin\theta + (\sqrt{3} + 1)\cos\theta = 2$ is

(a) $2n\pi \pm \frac{\pi}{4} + \frac{\pi}{12}$ (b) $n\pi + (-1)^n \frac{\pi}{4} + \frac{\pi}{12}$
(c) $2n\pi \pm \frac{\pi}{4} - \frac{\pi}{12}$ (d) $n\pi + (-1)^n \frac{\pi}{4} - \frac{\pi}{12}$

39. The general solution of $\tan 3x = 1$ is

(a) $n\pi + \frac{\pi}{4}$ (b) $\frac{n\pi}{3} + \frac{\pi}{12}$
(c) $n\pi$ (d) $n\pi \pm \frac{\pi}{4}$

40. The general solution of $\sin^2\theta \sec\theta + \sqrt{3}\tan\theta = 0$ is

(a) $\theta = n\pi + (-1)^{n+1}\frac{\pi}{3}, \theta = n\pi, n \in Z$
(b) $\theta = n\pi, n \in Z$
(c) $\theta = n\pi + (-1)^{n+1}\frac{\pi}{3}, n \in Z$
(d) $\theta = \frac{n\pi}{2}, n \in Z$

41. A person standing on the bank of a river finds that the angle of elevation of the top of a tower on the opposite bank is 45°. Then which of the following statements is correct

(a) Breadth of the river is twice the height of the tower
(b) Breadth of the river and the height of the tower are the same
(c) Breadth of the river is half of the height of the tower
(d) None of the above

42. AB is a vertical pole resting at the end A on the level ground. P is a point on the level ground such that AP = 3 AB. If C is the mid-point of AB and CB subtends an angle β at P, the value of $\tan\beta$ is

(a) $\frac{18}{19}$ (b) $\frac{3}{19}$
(c) $\frac{1}{6}$ (d) None of these

43. If $a_1, a_2, \ldots\ldots\ldots, a_n$ are in A.P. with common difference, d, then the sum of the following series is

$\sin d(\text{cosec } a_1 . \text{cosec } a_2 + \text{cosec } a_2 . \text{cosec } a_3 + \ldots\ldots\ldots + \text{cosec } a_{n-1} \text{cosec } a_n)$

(a) $\sec a_1 - \sec a_n$ (b) $\cot a_1 - \cot a_n$
(c) $\tan a_1 - \tan a_n$ (d) $\text{cosec } a_1 - \text{cosec } a_n$

44. If the sum of the series $2 + 5 + 8 + 11 \ldots\ldots\ldots$ is 60100, then the number of terms are

(a) 100 (b) 200
(c) 150 (d) 250

45. The sum of all natural numbers between 1 and 100 which are multiples of 3 is
(a) 1680 (b) 1683
(c) 1681 (d) 1682

46. If one of the lines of the pair $ax^2+2hxy+by^2=0$ bisects the angle between positive directions of the axes, then a, b, h satisfy the relation
(a) $a+b=2|h|$ (b) $a+b=-2h$
(c) $a-b=2|h|$ (d) $(a-b)^2=4h^2$

47. The lines joining the origin to the points of intersection of the line $y=mx+c$ and the circle $x^2+y^2=a^2$ will be mutually perpendicular, if
(a) $a^2(m^2+1)=c^2$ (b) $a^2(m^2-1)=c^2$
(c) $a^2(m^2+1)=2c^2$ (d) $a^2(m^2-1)=2c^2$

48. Given that $\int_0^\infty \frac{x^2\,dx}{(x^2+a^2)(x^2+b^2)(x^2+c^2)}=\frac{\pi}{2(a+b)(b+c)(c+a)}$, then the value of $\int_0^\infty \frac{x^2dx}{(x^2+4)(x^2+9)}$ is
(a) $\frac{\pi}{60}$ (b) $\frac{\pi}{20}$
(c) $\frac{\pi}{40}$ (d) $\frac{\pi}{80}$

49. If $I(m,n)=\int_0^1 t^m(1+t)^n\,dt,$ then the expression for $I(m,n)$ in terms of $I(m+1,n-1)$ is
(a) $\frac{2^n}{m+1}-\frac{n}{m+1}I(m+1,n-1)$
(b) $\frac{n}{m+1}I(m+1,n-1)$
(c) $\frac{2^n}{m+1}+\frac{n}{m+1}I(m+1,n-1)$
(d) $\frac{m}{n+1}I(m+1,n-1)$

50. $\lim_{n\to\infty}\frac{1+2^4+3^4+....+n^4}{n^5}-\lim_{n\to\infty}\frac{1+2^3+3^3+....+n^3}{n^5}=$
(a) $\frac{1}{30}$ (b) Zero
(c) $\frac{1}{4}$ (d) $\frac{1}{5}$

51. The greatest and least magnitude of the resultant of two forces of constant magnitude are F and G. When the forces act an angle 2α, the resultant in magnitudes is equal to
(a) $\sqrt{F^2\cos^2\alpha+G^2\sin^2\alpha}$
(b) $\sqrt{F^2\sin\alpha+G^2\cos^2\alpha}$
(c) $\sqrt{F^2+G^2}$
(d) $\sqrt{F^2-G^2}$

52. A horizontal force F is applied to a small object P of mass m on a smooth plane inclined to the horizon at an angle θ. If F is just enough to keep P in equilibrium, then F =
(a) $mg\cos^2\theta$ (b) $mg\sin^2\theta$
(c) $mg\cos\theta$ (d) $mg\tan\theta$

53. If the position of the resultant of two like parallel forces P and Q is unaltered, when the positions of P and Q are interchanged, then
(a) $P=Q$ (b) $P=2Q$
(c) $2P=Q$ (d) None of these

54. Three parallel forces P,Q, R act at three points A,B, C of a rod at distances of 2m, 8m and 6m respectively from one end. If the rod be in equilibrium, then $P:Q:R=$
(a) $1:2:3$ (b) $2:3:1$
(c) $3:2:1$ (d) None of these

55. The resultant of two like parallel forces is 12N. The distance between the forces is 18m. If one of the force is 4N, then the distance of the resultant from the smaller force is
(a) 4m (b) 8m
(c) 12m (d) None of these

56. A heavy uniform rod, 15cm long, is suspended from a fixed point by strings fastened to its ends, their lengths being 9 and 12 cm. If θ be the angle at which the rod is inclined to the vertical, then $\sin\theta=$
(a) $\frac{4}{5}$ (b) $\frac{8}{9}$
(c) $\frac{19}{20}$ (d) $\frac{24}{25}$

57. A light string of length l is fastened to two points A and B at the same level at a distance 'a' apart. A ring of weight W can slide on the string, and a horizontal force P is applied to it such that the ring is in equilibrium vertically below B. The tension in the string is equal to
(a) $\frac{aW}{l}$ (b) laW
(c) $\frac{W(l^2+a^2)}{2l^2}$ (d) $\frac{2W(l^2+a^2)}{2a^2}$

58. If $y=\frac{\sqrt{a+x}-\sqrt{a-x}}{\sqrt{a+x}+\sqrt{a-x}}$, then $\frac{dy}{dx}=$

(a) $\frac{ay}{x\sqrt{a^2-x^2}}$ (b) $\frac{ay}{\sqrt{a^2-x^2}}$

(c) $\frac{ay}{x\sqrt{x^2-a^2}}$ (d) None of these

59. If $y=(x\cot^3 x)^{3/2}$, then $dy/dx=$

(a) $\frac{3}{2}(x\cot^3 x)^{1/2}[\cot^3 x-3x\cot^2 x\,\text{cosec}^2 x]$

(b) $\frac{3}{2}(x\cot^3 x)^{1/2}[\cot^2 x-3x\cot^2 x\,\text{cosec}^2 x]$

(c) $\frac{3}{2}(x\cot^3 x)^{1/3}[\cot^3 x-3x\,\text{cosec}^2 x]$

(d) $\frac{3}{2}(x\cot^3 x)^{3/2}[\cot^3 x-3x\,\text{cosec}^2 x]$

60. $\frac{d}{dx}\{\cos(\sin x^2)\}=$

(a) $\sin(\sin x^2).\cos x^2.2x$ (b) $-\sin(\sin x^2).\cos x^2.2x$

(c) $-\sin(\sin x^2).\cos^2 x.2x$ (d) None of these

61. If $A=\begin{bmatrix}\cos\alpha & \sin\alpha\\ -\sin\alpha & \cos\alpha\end{bmatrix}$, then $A^2=$

(a) $\begin{bmatrix}\cos 2\alpha & \sin 2\alpha\\ \sin 2\alpha & \cos 2\alpha\end{bmatrix}$ (b) $\begin{bmatrix}\cos 2\alpha & -\sin 2\alpha\\ \sin 2\alpha & \cos 2\alpha\end{bmatrix}$

(c) $\begin{bmatrix}\cos 2\alpha & \sin 2\alpha\\ -\sin 2\alpha & \cos 2\alpha\end{bmatrix}$ (d) $\begin{bmatrix}-\cos 2\alpha & \sin 2\alpha\\ -\sin 2\alpha & -\cos 2\alpha\end{bmatrix}$

62. If $A=\begin{bmatrix}1 & 2 & 3\\ -2 & 3 & -1\\ 3 & 1 & 2\end{bmatrix}$ and I is a unit matrix of 3^{rd} order, then (A^2+9I) equals

(a) 2A (b) 4A

(c) 6A (d) None of these

63. If $A=\begin{bmatrix}1 & \tan\theta/2\\ -\tan\theta/2 & 1\end{bmatrix}$ and $AB=I$, then $B=$

(a) $\cos^2\frac{\theta}{2}.A$ (b) $\cos^2\frac{\theta}{2}.A^T$

(c) $\cos^2\frac{\theta}{2}.I$ (d) None of these

64. If $A=\begin{bmatrix}4 & 2\\ -1 & 1\end{bmatrix}$ and I is the identity matrix of order 2, then $(A-2I)(A-3I)=$

(a) I (b) O

(c) $\begin{bmatrix}1 & 0\\ 0 & 0\end{bmatrix}$ (d) $\begin{bmatrix}0 & 0\\ 0 & 1\end{bmatrix}$

65. If $A=\begin{bmatrix}1 & 2 & 1\\ 0 & 1 & -1\\ 3 & -1 & 1\end{bmatrix}$, then

(a) $A^3+3A^2+A-9I_3=O$

(b) $A^3-3A^2+A+9I_3=O$

(c) $A^3+3A^2-A+9I_3=O$

(d) $A^3-3A^2-A+9I_3=O$

66. If A and B are two sets then (A – B) ∪ (B – A) ∪ (A ∩ B) is equal to

(a) A ∪ B (b) A ∩ B

(c) A (d) B'

67. Let A and B be two sets then $(A\cup B)'\cup(A'\cap B)$ is equal to

(a) A' (b) A

(c) B' (d) None of these

68. Let U be the universal set and $A\cup B\cup C=U$. Then $\{(A-B)\cup(B-C)\cup(C-A)\}'$ is equal to

(a) $A\cup B\cup C$ (b) $A\cup(B\cap C)$

(c) $A\cap B\cap C$ (d) $A\cap(B\cup C)$

69. If $n(A)=3$, $n(B)=6$ and $A\subseteq B$. Then the number of elements in $A\cup B$ is equal to

(a) 3 (b) 9

(c) 6 (d) None of these

70. Let A and B be two sets such that $n(A)=0.16, n(B)=0.14, n(A\cup B)=0.25$. Then $n(A\cap B)$ is equal to

(a) 0.3 (b) 0.5

(c) 0.05 (d) None of these

71. R is a relation over the set of real numbers and it is given by $nm\geq 0$. Then R is

(a) Symmetric and transitive

(b) Reflexive and symmetric

(c) A partial order relation

(d) An equivalence relation

72. In order that a relation R defined on a non-empty set A is an equivalence relation, it is sufficient, if R

(a) Is reflexive

(b) Is symmetric

(c) Is transitive

(d) Possesses all the above three properties

73. The relation "congruence modulo m" is

(a) Reflexive only

(b) Transitive only

(c) Symmetric only

(d) An equivalence relation

74. Domain of the function $\sqrt{\log\{(5x-x^2)/6\}}$ is
(a) (2, 3) (b) [2, 3]
(c) [1, 2] (d) [1, 3]

75. Domain of the function $\sqrt{2-x}-\frac{1}{\sqrt{9-x^2}}$ is
(a) (–3, 1) (b) [–3, 1]
(c) (–3, 2] (d) [–3, 1)

76. $\lim_{\theta\to 0}\frac{1-\cos\theta}{\theta^2}=$
(a) 1 (b) 2
(c) $\frac{1}{2}$ (d) $\frac{1}{4}$

77. $\lim_{\theta\to 0}\frac{\sin 3\theta-\sin\theta}{\sin\theta}=$
(a) 1 (b) 2
(c) 1/3 (d) 3/2

78. If $f(x)=\begin{cases}\frac{1-(x)}{1+x}, & x\neq -1\\ 1, & x=-1\end{cases}$, then the value of $f(|2k|)$ will be (where [ ] shows the greatest integer function)
(a) Continuous at $x=-1$
(b) Continuous at $x=0$
(c) Discontinuous at $x=\frac{1}{2}$
(d) All of these

79. Function $f(x)=\frac{1-\cos 4x}{8x^2}$, where $x\neq 0$ and $f(x)=k$ where $x=0$ is a continous function at $x=0$ then the value of k will be
(a) $k=0$ (b) $k=1$
(c) $k=-1$ (d) None of these

80. The function $f(x)=\begin{cases}e^{2x}-1, & x\leq 0\\ ax+\frac{bx^2}{2}-1, & x>0\end{cases}$ is continuous and differentiable for
(a) $a=1, b=2$ (b) $a=2, b=4$
(c) $a=2$, any b (d) Any a, $b=4$

81. If $\alpha\neq\beta$ but $\alpha^2=5\alpha-3$ and $\beta^2=5\beta-3$, then the equation whose roots are α/β and β/α is
(a) $3x^2-25x+3=0$ (b) $x^2+5x-3=0$
(c) $x^2-5x+3=0$ (d) $3x^2-19x+3=0$

82. Difference between the corresponding roots of $x^2+ax+b=0$ and $x^2+bx+a=0$ is same and $a\neq b$, then
(a) $a+b+4=0$ (b) $a+b-4=0$
(c) $a-b-4=0$ (d) $a-b+4=0$

83. Product of real roots of the equation $t^2x^2+|x|+9=0$
(a) Is always positive (b) Is always negative
(c) Does not exist (d) None of these

84. If the roots of the equation $12x^2-mx+5=0$ are in the ratio 2 : 3, then m =
(a) $5\sqrt{10}$ (b) $3\sqrt{10}$
(c) $2\sqrt{10}$ (d) None of these

85. If one root of the equation $x^2+px+q=0$ is $2+\sqrt{3}$, then values of p and q are
(a) – 4, 1 (b) 4, – 1
(c) 2, $\sqrt{3}$ (d) $-2, -\sqrt{3}$

86. The condition that one root of the equation $ax^2+bx+c=0$ is three times the other is
(a) $b^2=8ac$ (b) $3b^2+16ac=0$
(c) $3b^2=16ac$ (d) $b^2+3ac=0$

87. The equation whose roots are reciprocal of the roots of the equation $3x^2-20x+17=0$ is
(a) $3x^2+20x-17=0$ (b) $17x^2-20x+3=0$
(c) $17x^2+20x+3=0$ (d) None of these

88. If α, β are the roots of the equation $x^2+2x+4=0$, then $\frac{1}{\alpha^3}+\frac{1}{\beta^3}$ is equal to
(a) $-\frac{1}{2}$ (b) $\frac{1}{2}$
(c) 32 (d) $\frac{1}{4}$

89. The equation of the smallest degree with real coefficients having $1+i$ as one of the root is
(a) $x^2+x+1=0$ (b) $x^2-2x+2=0$
(c) $x^2+2x+2=0$ (d) $x^2+2x-2=0$

90. The order of the differential equation whose solution is $x^2+y^2+2gx+2fy+c=0$, is
(a) 1 (b) 2
(c) 3 (d) 4

91. The order of the differential equation of all circles of radius r, having centre on y-axis and passing through the origin is
(a) 1 (b) 2
(c) 3 (d) 4

92. The order of the differential equation whose solution is $y=a\cos x+b\sin x+ce^{-x}$ is
(a) 3 (b) 2
(c) 1 (d) None of these

93. The differential equation of all circles of radius a is of order

(a) 2 (b) 3
(c) 4 (d) None of these

94. The differential equation of all circles in the first quadrant which touch the coordinate axes is of order

(a) 1 (b) 2
(c) 3 (d) None of these

95. Order and degree of differential equation $\frac{d^2y}{dx^2} = \left\{y + \left(\frac{dy}{dx}\right)^2\right\}^{1/4}$ are

(a) 4 and 2 (b) 1 and 2
(c) 1 and 4 (d) 2 and 4

96. If the position vectors of the points A, B, C be $\mathbf{a}, \mathbf{b}$, $3\mathbf{a} - 2\mathbf{b}$ respectively, then the points A, B, C are

(a) Collinear (b) Non-collinear
(c) Form a right angled triangle(d) None of these

97. If **a, b, c** are non-collinear vectors such that for some scalars x, y, z, $x\mathbf{a} + y\mathbf{b} + z\mathbf{c} = \mathbf{0}$, then

(a) $x = 0, y = 0, z = 0$ (b) $x \neq 0, y \neq 0, z = 0$
(c) $x = 0, y \neq 0, z \neq 0$ (d) $x \neq 0, y \neq 0, z \neq 0$

98. The vectors $3\mathbf{i} + \mathbf{j} - 5\mathbf{k}$ and $a\mathbf{i} + b\mathbf{j} - 15\mathbf{k}$ are collinear, if

(a) $a = 3, b = 1$ (b) $a = 9, b = 1$
(c) $a = 3, b = 3$ (d) $a = 9, b = 3$

99. The points with position vectors $60\mathbf{i} + 3\mathbf{j}$, $40\mathbf{i} - 8\mathbf{j}$, , $a\mathbf{i} - 52\mathbf{j}$ are collinear, if $a =$

(a) – 40 (b) 40
(c) 20 (d) None of these

100. If O be the origin and the position vector of A be $4\mathbf{i} + 5\mathbf{j}$, then a unit vector parallel to $\overrightarrow{OA}$ is

(a) $\frac{4}{\sqrt{41}}\mathbf{i}$ (b) $\frac{5}{\sqrt{41}}\mathbf{i}$
(c) $\frac{1}{\sqrt{41}}(4\mathbf{i} + 5\mathbf{j})$ (d) $\frac{1}{\sqrt{41}}(4\mathbf{i} - 5\mathbf{j})$

101. If the position vectors of the points A and B be $2\mathbf{i} + 3\mathbf{j} - \mathbf{k}$ and $-2\mathbf{i} + 3\mathbf{j} + 4\mathbf{k}$, then the line AB is parallel to

(a) xy-plane (b) yz-plane
(c) zx-plane (d) None of these

102. The points with position vectors $10\mathbf{i} + 3\mathbf{j}$, $12\mathbf{i} - 5\mathbf{j}$ and $a\mathbf{i} + 11\mathbf{j}$ are collinear, if $a =$

(a) – 8 (b) 4
(c) 8 (d) 12

103. Three points whose position vectors are $\mathbf{a} + \mathbf{b}$, $\mathbf{a} - \mathbf{b}$ and $\mathbf{a} + k\mathbf{b}$ will be collinear, if the value of k is

(a) Zero
(b) Only negative real number
(c) Only positive real number
(d) Every real number

104. If the position vectors of A, B, C, D are $2\mathbf{i} + \mathbf{j}$, $\mathbf{i} - 3\mathbf{j}$, $3\mathbf{i} + 2\mathbf{j}$ and $\mathbf{i} + \lambda\mathbf{j}$ respectively and $\overrightarrow{AB} \,||\, \overrightarrow{CD}$, then λ will be

(a) – 8 (b) – 6
(c) 8 (d) 6

105. The co-ordinates of the point where the line $\frac{x-6}{-1} = \frac{y+1}{0} = \frac{z+3}{4}$ meets the plane $x + y - z = 3$ are

(a) (2, 1, 0) (b) (7, –1, –7)
(c) (1, 2, –6) (d) (5, –1, 1)

106. If a plane passes through the point (1,1,1) and is perpendicular to the line $\frac{x-1}{3} = \frac{y-1}{0} = \frac{z-1}{4}$, then its perpendicular distance from the origin is

(a) $\frac{3}{4}$ (b) $\frac{4}{3}$
(c) $\frac{7}{5}$ (d) 1

107. The angle between the line $\frac{x-1}{2} = \frac{y-2}{1} = \frac{z+3}{-2}$ and the plane $x + y + 4 = 0$, is

(a) 0° (b) 30°
(c) 45° (d) 90°

108. The equation of the plane containing the line $\frac{x+1}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$ and the point (0, 7, –7) is

(a) $x + y + z = 1$ (b) $x + y + z = 2$
(c) $x + y + z = 0$ (d) None of these

109. The xy-plane divides the line joining the points (–1, 3, 4) and (2, –5, 6)

(a) Internally in the ratio 2 : 3
(b) Internally in the ratio 3 : 2
(c) Externally in the ratio 2 : 3
(d) Externally in the ratio 3 : 2

110. Under what condition does a straight line $\frac{x - x_0}{l} = \frac{y - y_0}{m} = \frac{z - z_0}{n}$ is parallel to the xy-plane

(a) $l = 0$ (b) $m = 0$
(c) $n = 0$ (d) $l = 0, m = 0$

111. If $P(A)=\frac{1}{2}, P(B)=\frac{1}{3}$ and $P(A\cap B)=\frac{7}{12}$, then the value of $P(A'\cap B')$ is

(a) $\frac{7}{12}$ (b) $\frac{3}{4}$

(c) $\frac{1}{4}$ (d) $\frac{1}{6}$

112. In a city 20% persons read English newspaper, 40% read Hindi newspaper and 5% read both newspapers. The percentage of non-reader either paper is

(a) 60% (b) 35%

(c) 25% (d) 45%

113. The probability that at least one of A and B occurs is 0.6. If A and B occur simultaneously with probability 0.3, then $P(A')+P(B')=$

(a) 0.9 (b) 1.15

(c) 1.1 (d) 1.2

114. The probability that a man will be alive in 20 years is $\frac{3}{5}$ and the probability that his wife will be alive in 20 years is $\frac{2}{3}$. Then the probability that at least one will be alive in 20 years, is

(a) $\frac{13}{15}$ (b) $\frac{7}{15}$

(c) $\frac{4}{15}$ (d) None of these

115. Given two mutually exclusive events A and B such that $P(A)=0.45$ and $P(B)=0.35,$ then P (A or B) =

(a) 0.1 (b) 0.25

(c) 0.15 (d) 0.8

116. If A and B are any two events, then $P(A\cup B)=$

(a) $P(A)+P(B)$

(b) $P(A)+P(B)+P(A\cap B)$

(c) $P(A)+P(B)-P(A\cap B)$

(d) $P(A)\,.\,P(B)$

117. The value of θ lying between 0 and $\pi/2$ and satisfying the equation

$$\begin{vmatrix} 1+\sin^2\theta & \cos^2\theta & 4\sin 4\theta \\ \sin^2\theta & 1+\cos^2\theta & 4\sin 4\theta \\ \sin^2\theta & \cos^2\theta & 1+4\sin 4\theta \end{vmatrix}=0$$

(a) $\frac{7\pi}{24}$ or $\frac{11\pi}{24}$ (b) $\frac{5\pi}{24}$

(c) $\frac{\pi}{24}$ (d) None of these

118. If cot $(\alpha+\beta)=0,$ then $\sin(\alpha+2\beta)=$

(a) $\sin\alpha$ (b) $\cos\alpha$

(c) $\sin\beta$ (d) $\cos 2\beta$

119. If n is any integer, then the general solution of the equation $\cos x-\sin x=\frac{1}{\sqrt{2}}$ is

(a) $x=2n\pi-\frac{\pi}{12}$ or $x=2n\pi+\frac{7\pi}{12}$

(b) $x=n\pi\pm\frac{\pi}{12}$

(c) $x=2n\pi+\frac{\pi}{12}$ or $x=2n\pi-\frac{7\pi}{12}$

(d) $x=n\pi+\frac{\pi}{12}$ or $x=n\pi-\frac{7\pi}{12}$

120. The general solution of $\sin x-\cos x=\sqrt{2}$, for any integer n is

(a) $n\pi$ (b) $2n\pi+\frac{3\pi}{4}$

(c) $2n\pi$ (d) $(2n+1)\pi$

* * *