PAPER – II
MATHEMATICS

1. If $A = \{x : x = 3^n, n \le 6, n \in N\}$ and $B = \{x : x = 9^n, n \le 4, n \in N\}$, then which of the following is false?

(a) $A \cup B$ = {3, 9, 27, 81, 243, 729, 6561}
(b) $A \cap B$ = {9, 81, 729, 6561}
(c) $A - B$ = {3, 27, 243}
(d) $A \Delta B$ = {3, 27, 243, 6561}

2. Let a relation R be defined by R = {(4, 5), (1, 4), (4, 6), (7, 6), (3, 7)}. The relation $R^{-1}oR$ is given by

(a) {(1, 1), (4, 4), (7, 4), (4, 7), (7, 7)
(b) {(1, 1), (4, 4), (4, 7), (7, 4), (7, 7), (3, 3)}
(c) {(1, 5), (1, 6), (3, 6)}
(d) none of these

3. Let $f : [0, \infty) \to [0, 2]$ be defined by $f(x) = \frac{2x}{1+x}$, then f is

(a) one-one but not onto
(b) onto but not one-one
(c) both one-one and onto
(d) neither one-one nor onto

4. The value of $n \in I$ for which the function $f(x) = \frac{\sin nx}{\sin\left(\frac{x}{n}\right)}$ has 4π as its period is

(a) 2 (b) 3 (c) 4 (d) 5

5. The conjugate of a complex number is $\frac{1}{i-1}$. Then that complex number is

(a) $\frac{-1}{i+1}$ (b) $\frac{1}{i-1}$ (c) $\frac{-1}{i-1}$ (d) $\frac{1}{i+1}$

6. If z is any complex number satisfying $|z - 1| = 1$, then which of the following is correct?

(a) $\arg(z-1) = 2\arg z$
(b) $2\arg(z) = \frac{2}{3}\arg(z^2 - z)$
(c) $\arg(z-1) = \arg(z+1)$
(d) $\arg(z) = 2\arg(z+1)$

7. If one root of the equation $ix^2 - 2(1+i)x + (2-i) = 0$ is $2 - i$, then the other root is

(a) i (b) $2 + i$ (c) $-i$ (d) $2 - i$

8. The product of the roots of the equation $mx^2 + 6x + (2m-1) = 0$ is -1. Then m is equal to

(a) 1 (b) $\frac{1}{3}$ (c) -1 (d) $-\frac{1}{3}$

9. If n arithmetic means are inserted between 2 and 38, and the sum of the resulting series is obtained as 200, then the value of n is

(a) 6 (b) 8 (c) 9 (d) 10

10. If $2(y-a)$ is the H.M. between $y-x$ and $y-z$, then $x-a$, $y-a$, $z-a$ are in

(a) A.P. (b) G.P. (c) H.P. (d) none of these

11. If $x^2+6x-27>0$ and $x^2-3x-4<0$, then

(a) $x>3$ (b) $x<4$ (c) $3<x<4$ (d) $x=\frac{7}{2}$

12. Given 5 line segments of lengths 2, 3, 4, 5, 6 units. Then the number of triangles that can be formed by joining these lines is

(a) ${}^4C_3$ (b) ${}^5C_3-3$ (c) ${}^5C_3-2$ (d) ${}^5C_3-1$

13. The number of 3 digit numbers lying between 100 and 999 inclusive and having only two consecutive digits identical is

(a) 100 (b) 162 (c) 150 (d) none of these

14. The greatest positive integer, which divides $(n+16)(n+17)(n+18)(n+19)$, for all $n \in N$, is

(a) 2 (b) 4 (c) 24 (d) 120

15. Coefficient of x^{-4} in $\left(\frac{3}{2}-\frac{3}{x^2}\right)^{10}$ is

(a) $\frac{405}{226}$ (b) $\frac{504}{289}$ (c) $\frac{450}{263}$ (d) none of these

16. The coefficient of x^{53} in $\sum_{r=0}^{100} {}^{100}C_r (x-3)^{100-r} 2^r$ is

(a) ${}^{100}C_{51}$ (b) ${}^{100}C_{52}$ (c) $-{}^{100}C_{53}$ (d) ${}^{100}C_{54}$

17. If $4^{\log_9 3}+9^{\log_2 4}=10^{\log_x 83}$, $(x \in R)$ then x is

(a) 4 (b) 9 (c) 10 (d) none of these

18. The maximum value of $12\sin\theta-9\sin^2\theta$ is

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

19. If $\tan(\pi \cos x) = \cot(\pi \sin x)$, then $\cos\left(x-\frac{\pi}{4}\right)$ is

(a) $\frac{1}{\sqrt{2}}$ (b) $\frac{1}{2\sqrt{2}}$ (c) 0 (d) none of these

20. General solution for θ if $\sin\left(2\theta+\frac{\pi}{6}\right)+\cos\left(\theta+\frac{5\pi}{6}\right)=2$, is

(a) $2n\pi+\frac{7\pi}{6}$ (b) $2n\pi+\frac{\pi}{6}$ (c) $2n\pi-\frac{7\pi}{6}$ (d) none of these

21. In a ΔABC if $a^2\sin(B-C)+b^2\sin(C-A)+c^2\sin(A-B)=0$, then triangle is

(a) right angled (b) obtuse angled (c) isosceles (d) none of these

22. If $|y|<|x|$ and $xy>0$, then the value of $\tan^{-1}\frac{x}{y}-\tan^{-1}\frac{x-y}{x+y}$ is equal to

(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{4}$ (d) $-\frac{3\pi}{4}$

23. If a point $P(2, 3)$ is shifted by a distance $\sqrt{2}$ units parallel to the line $y = x$ then coordinates of P in the new position are

(a) (3, 4) (b) $(2+\sqrt{2}, 3+\sqrt{2})$

(c) $(2-\sqrt{2}, 3-\sqrt{2})$ (d) none of these

24. The line $(a + b)x + (a - b)y = 2a + 3b$ (where $a, b \neq 0$, $b \in R$) always passes through the fixed point

(a) $\left(\frac{5}{2}, \frac{1}{2}\right)$ (b) $\left(\frac{5}{2}, \frac{-1}{2}\right)$ (c) $\left(\frac{-5}{2}, \frac{-1}{2}\right)$ (d) $\left(\frac{-5}{2}, \frac{1}{2}\right)$

25. (0, 0) and $(3, 3\sqrt{3})$ are two vertices of an equilateral triangle, then the third vertex is

(a) (3, – 3) (b) (3, 3) (c) $(-3, 3\sqrt{3})$ (d) none of these

26. Equation of a circle through $(1, -2)$ and concentric with the circle $x^2+y^2-3x+4y-c=0$ is

(a) $x^2+y^2-3x+4y-1=0$ (b) $x^2+y^2-3x+4y=0$

(c) $x^2+y^2-3x+4y+2=0$ (d) none of these

27. Let the circles $x^2+y^2+6x+k=0$ and $x^2+y^2+8y-20=0$ touching each other internally, then value of k is

(a) 6 (b) 9 (c) 8 (d) none of these

28. Equation of tangent to the parabola $y^2 = 4ax$ parallel to $y = 2x + 3$ is

(a) $y = 2x + a$ (b) $2y = 4x - a$ (c) $2y = 4x + a$ (d) none of these

29. Angle subtended by latus rectum of $y^2 = 4x$ at the origin is

(a) $\pi - \tan^{-1}\left(\frac{4}{3}\right)$ (b) $\pi - \tan^{-1}\left(\frac{3}{4}\right)$ (c) $\tan^{-1}\frac{4}{3}$ (d) none of these

30. If $\sqrt{3}bx + ay = 2ab$ is tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ at point P of the point P, then eccentric angle θ is

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{3}$

31. For the hyperbola $\frac{x^2}{\cos^2\theta} - \frac{y^2}{\sin^2\theta} = 1$, which of the following remains constant with change in θ

(a) abscissa of vertices (b) abscissa of foci

(c) eccentricity (d) directrix

32. If a, b, c are in AP, then value of $\begin{vmatrix} 1 & 2 & a \\ 2 & 3 & b \\ 3 & 4 & c \end{vmatrix}$ is

(a) $a + c$ (b) $2(a + c)$ (c) b (d) none of these

33. If $A = \begin{bmatrix} i & 0 \\ 0 & i \end{bmatrix}$, $n \in N$ then A^{4n} equals

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

34. If $A = \begin{bmatrix} \cos^2\theta & \cos\theta\sin\theta \\ \cos\theta\sin\theta & \sin^2\theta \end{bmatrix}$ and $B = \begin{bmatrix} \cos^2\phi & \cos\phi\sin\phi \\ \cos\phi\sin\phi & \sin^2\phi \end{bmatrix}$ are two matrices such that the product AB is the null matrix then $\theta - \phi$ is equal to

(a) 0 (b) multiple of π

(c) an odd multiple of $\frac{\pi}{2}$ (d) none of these

35. The domain of the function $f(x) = \sqrt{\log_{0.5} x}$ is

(a) $(0, 1]$ (b) $(0, \infty)$ (c) $(.5, \infty)$ (d) $[1, \infty)$

36. The inverse of the function $f(x) = \dfrac{e^x - e^{-x}}{e^x + e^{-x}} + 2$ is given by

(a) $\log_e\left(\dfrac{x-2}{x-1}\right)^{1/2}$ (b) $\log_e\left(\dfrac{x-1}{3-x}\right)^{1/2}$ (c) $\log_e\left(\dfrac{x}{2-x}\right)^{1/2}$ (d) $\log_e\left(\dfrac{x-1}{x+1}\right)^{-2}$

37. $\lim\limits_{x\to\infty}\left(\dfrac{x^2 \sin\frac{1}{x} - x}{1-|x|}\right)$ is

(a) 0 (b) 1 (c) – 1 (d) none of these

38. The number of points at which the function $f(x) = |x + 1| + |\cos x| + \tan\left(x + \dfrac{\pi}{4}\right)$ does not have a derivative in the interval (– 1, 2) is

(a) 1 (b) 2 (c) 3 (d) 4

39. $\lim\limits_{x\to 0}\dfrac{\tan[e^2]x^2 - \tan[-e^2]x^2}{\sin^2 x}$ is (where [·] is greatest integer function)

(a) 0 (b) 8 (c) 15 (d) none of these

40. The function $f(x) = [x]^2 - [x^2]$ (where [y] is the largest integer $\le y$) is discontinuous at

(a) all integers (b) all integers except 0 and 1

(c) all integers except 0 (d) all integers except 1

41. If $\int_0^x f(t)\,dt = x^2 + \int_x^1 t f(t)\,dt,$ then $f(1) =$

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

42. $\displaystyle\int_0^\pi \frac{x\sin 2x \sin\left[\frac{\pi}{2}\cos x\right]}{2x-\pi}\,dx =$

(a) $\dfrac{8}{\pi^2}$ (b) $\dfrac{2}{\pi}$ (c) $\dfrac{1}{\pi^2}$ (d) none of these

43. The area bounded by the curves $x^2 + y^2 \le 1$ and $|x| + |y| \ge 1$ is

(a) 2 sq. units (b) π + 2 sq.units (c) π – 2 sq. units (d) none of these

44. Solution of $2y\sin x\dfrac{dy}{dx}=2\sin x\cos x-y^2\cos x, x=\dfrac{\pi}{2}$, $y = 1$ is given by

(a) $y^2=\sin x$ (b) $y=\sin^2 x$ (c) $y^2=\cos x+1$ (d) none of these

45. The differential equation of all circles which pass through the origin and whose centres lies on y-axis is

(a) $(x^2-y^2)\dfrac{dy}{dx}-2xy=0$

(b) $(x^2-y^2)\dfrac{dy}{dx}+2xy=0$

(c) $(x^2-y^2)\dfrac{dy}{dx}-xy=0$

(d) $(x^2-y^2)\dfrac{dy}{dx}+xy=0$

46. If $4\hat{i}+7\hat{j}+8\hat{k}, 2\hat{i}+3\hat{j}+4\hat{k}$ and $2\hat{i}+5\hat{j}+7\hat{k}$ are the position vectors of the vertices A, B and C of triangle ABC, the position vector of the point where the bisector of $\angle A$ meets BC is

(a) $\dfrac{2}{3}(-6\hat{i}-8\hat{j}-6\hat{k})$

(b) $\dfrac{2}{3}(6\hat{i}+8\hat{j}+6\hat{k})$

(c) $\dfrac{1}{3}(6\hat{i}+13\hat{j}+18\hat{k})$

(d) $\dfrac{1}{3}(5\hat{i}+12\hat{k})$

47. If the difference of two unit vectors is again a unit vector, then the angle between them is

(a) 30º (b) 40º (c) 60º (d) 90º

48. If $\vec{a},\vec{b},\vec{c}$ are three vectors such that $\vec{a}\cdot(\vec{b}+\vec{c})+\vec{b}\cdot(\vec{c}+\vec{a})+\vec{c}\cdot(\vec{a}+\vec{b})=0$ and $|\vec{a}|=1, |\vec{b}|=4, |\vec{c}|=8,$ then $|\vec{a}+\vec{b}+\vec{c}|=$

(a) 13 (b) 81 (c) 9 (d) 5

49. The coordinates of the centre of the sphere $(x + 1)(x + 3) + (y - 2)(y - 4) + (z + 1)(z + 3) = 0$ are

(a) 1, – 1, 1) (b) (– 1, 1, – 1) (c) (2, – 3, 2) (d) (– 2, 3, – 2)

50. The ratio in which the plane $\vec{r}\cdot(\hat{i}-2\hat{j}+3\hat{k})=17$ divides the line joining the points $-2\hat{i}+4\hat{j}+7\hat{k}$ and $3\hat{i}-5\hat{j}+8\hat{k}$ is

(a) 1 : 5 (b) 1 : 10 (c) 3 : 5 (d) 3 : 10

51. Workers work in three shifts I, II, III in a factory. Their wages are in the ratio 4 : 5 : 6 depending upon the shift. Number of workers in the shifts are in the ratio 3 : 2 : 1. If total number of workers working is 1500 and wages per worker in shift I is Rs. 400. Then mean wage of a worker is

(a) Rs. 467 (b) Rs. 500 (c) Rs. 600 (d) Rs. 400

52. A bag contains 5 brown socks and 4 white socks. A man selects two socks from the bag without replacement. The probability that the selected socks will be of the same colour, is

(a) $\frac{5}{108}$ (b) $\frac{1}{6}$ (c) $\frac{5}{18}$ (d) $\frac{4}{9}$

53. If on an average 2 ships in every 10, sinks. The probability that out of 5 ships expected to arrive, at least three will arrive safely, is

(a) $\frac{2944}{3125}$ (b) $\frac{2946}{3125}$ (c) $\frac{2945}{3125}$ (d) none of these

54. A body is projected vertically upwards from a tower of height 192 ft. If it strikes the ground in 6 seconds, then the velocity with which the body is projected is

(a) 64 ft./sec (b) 32 ft./sec (c) 16 ft./sec (d) none of these

55. In a projectile motion horizontal range R is maximum, then relation between height H and R is

(a) $H = \frac{R}{2}$ (b) $H = \frac{R}{4}$ (c) $H = 2R$ (d) $H = \frac{R}{8}$

56. The mean and variance of a random variable X having a binomial distribution are 4 and 2 respectively. Then, $P(X = 1)$ is

(a) $\frac{1}{32}$ (b) $\frac{1}{16}$ (c) $\frac{1}{8}$ (d) $\frac{1}{4}$

57. Let $f : R \to R$ be a function defined by $f(x) = \max\{x, x^3\}$. The set of all points where $f(x)$ is not differentiable is

(a) {– 1, 1} (b) {– 1, 0} (c) {0, 1} (d) {– 1, 0, 1}

58. $\int x f'(ax^2+b) \{f(ax^2+b)\}^{\frac{1}{2}} dx =$

(a) $\frac{1}{3a} \{f(ax^2+b)\}^{3/2} + C$ (b) $\frac{x\{f(ax^2+b)\}^{3}}{3} + C$

(c) $\frac{\{f(ax^2+b)\}^{3}}{3a} + C$ (d) none of these

59. If sin α + sin β = a and cos α + cos β = b, then value of $\tan\left(\frac{\alpha-\beta}{2}\right)$ is

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

60. The vertices of a triangle *ABC* are (1, 1), (4, – 2) and (5, 5) respectively. The equation of perpendicular dropped from *C* to the internal bisector of angle *A* is

(a) $y - 5 = 0$ (b) $x - 5 = 0$ (c) $2x + 3y - 7 = 0$ (d) none of these

61. Two finite sets have *m* and *n* elements. The total number of subsets of the first set is 56 more than the total number of subsets of the second set. The values of *m* and *n* are

(a) 7, 6 (b) 6, 3
(c) 5, 1 (d) 8, 7

62. If $\left(\frac{1+i}{1-i}\right)^x = 1$, then

(a) $x = 4n$, where *n* is any positive integer
(b) $x = 2n$, where *n* is any positive integer
(c) $x = 4n+1$, where *n* is any positive integer
(d) $x = 2n+1$, where *n* is any positive integer

63. If $z = x - iy$ and $z^{1/3} = p + iq$, then $\left(\frac{x}{p} + \frac{y}{q}\right)/(p^2 + q^2)$ is equal to

(a) – 2 (b) – 1
(c) 2 (d) 1

64. If α and β are different complex numbers with $|\beta| = 1$, then $\left|\frac{\beta - \alpha}{1 - \alpha\bar{\beta}}\right|$ is equal to

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

65. If *a, b, c* are in A.P., then the straight line $ax + by + c = 0$ will always pass through the point

(a) (–1, –2) (b) (1, –2)
(c) (–1, 2) (d) (1, 2)

66. If $\frac{S_n}{S_m} = \frac{n^2}{m^2}$ (where S_k is the sum of first *k* terms of an A.P., $a_1, a_2, a_3, \ldots$), then the value of $\frac{a_{m+1}}{a_{n+1}}$ in terms of *m* and *n* will be

(a) $\frac{(2m+1)^2}{(2n+1)^2}$ (b) $\frac{(2n+1)^2}{(2m+1)^2}$

(c) $\frac{(2m-1)^2}{(2n-1)^2}$ (d) $\frac{(2n-1)^2}{(2m-1)^2}$

67. If $|x^2 - x - 6| = x + 2$, then the values of *x* are

(a) – 2, 2, –4 (b) – 2, 2, 4

(c) 3, 2, –2 (d) 4, 4, 3

68. The solution of the equation $2x^2 + 3x - 9 \le 0$ is given by

(a) $\frac{3}{2} \le x \le 3$ (b) $-3 \le x \le \frac{3}{2}$

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

69. The value of a for which the quadratic equation $3x^2 + 2(a^2+1)x + (a^2 - 3a + 2) = 0$ possesses roots with opposite sign, lies in

(a) $(-\infty, 1)$ (b) $(-\infty, 0)$

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

70. The number of ways in which five identical balls can be distributed among ten different boxes such that no box contains more than one ball, is

(a) 10 ! (b) $\frac{10!}{5!}$

(c) $\frac{10!}{(5!)^2}$ (d) none of these

71. Eight chairs are numbered 1 to 8. Two women and three men wish to occupy one chair each. First the women choose the chairs from amongst the chairs marked 1 to 4 and then men select the chairs from amongst the remaining. The number of possible arrangements is

(a) ${}^6C_3 \times {}^4C_2$ (b) ${}^4C_3 \times {}^4C_3$

(c) ${}^4P_2 \times {}^4P_3$ (d) none of these

72. If $\frac{T_2}{T_3}$ in the expansion of $(a+b)^n$ and $\frac{T_3}{T_4}$ in the expansion of $(a+b)^{n+3}$ are equal, then n =

(a) 3 (b) 4

(c) 5 (d) 6

73. If n is a positive integer and $C_k = {}^nC_k$, then the value of $\sum_{k=1}^{n} k^3 \left(\frac{C_k}{C_{k-1}}\right)^2 =$

(a) $\frac{n(n+1)(n+2)}{12}$ (b) $\frac{n(n+1)^2}{12}$

(c) $\frac{n(n+2)^2(n+1)}{12}$ (d) none of these

74. If $y = x - \frac{x^2}{2} + \frac{x^3}{3} + \ldots\infty$, then x =

(a) $y-\frac{y^2}{2}+\frac{y^3}{3}+\ldots\infty$

(b) $y+\frac{y^2}{2!}+\frac{y^3}{3!}+\ldots\infty$

(c) $1+y+\frac{y^2}{2!}+\frac{y^3}{3!}+\ldots\infty$

(d) none of these

75. If α, β are the roots of the equation $x^2-px+q=0$, then $\log_e(1+px+qx^2)=$

(a) $(\alpha+\beta)x-\frac{\alpha^2+\beta^2}{2}x^2+\frac{\alpha^3+\beta^3}{3}x^3-\ldots\infty$

(b) $(\alpha+\beta)x-\frac{(\alpha+\beta)^2}{2}x^2+\frac{(\alpha+\beta)^3}{3}x^3-\ldots\infty$

(c) $(\alpha+\beta)x-\frac{\alpha^2+\beta^2}{2}x^2+\frac{\alpha^3+\beta^3}{3}x^3+\ldots\infty$

(d) none of these

76. If $A=\begin{vmatrix}\sin(\theta+\alpha) & \cos(\theta+\alpha) & 1\\ \sin(\theta+\beta) & \cos(\theta+\beta) & 1\\ \sin(\theta+\gamma) & \cos(\theta+\gamma) & 1\end{vmatrix}$, then

(a) $A=0$ for all θ

(b) A is an odd Function of θ

(c) $A = 0$ for $\theta = \alpha + \beta + \gamma$

(d) A is independent of θ

77. The number of distinct real roots of $\begin{vmatrix}\sin x & \cos x & \cos x\\ \cos x & \sin x & \cos x\\ \cos x & \cos x & \sin x\end{vmatrix}=0$ in the internal $-\frac{\pi}{4}\le x\le\frac{\pi}{4}$ is

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

78. Matrix A is such that $A^2=2A-I$, where I is the identity matrix. Then for $n\ge 2, A^n$ =

(a) $nA-(n-1)I$

(b) $nA-I$

(c) $2^{n-1}A-(n-1)I$

(d) $2^{n-1}A-I$

79. The value of k, for which $(\cos x+\sin x)^2+k\sin x\cos x-1=0$ is an identity, is

(a) – 1 (b) – 2 (c) 0 (d) 1

80. If $\tan(A-B)=1$, $\sec(A+B)=\frac{2}{\sqrt{3}}$, then the smallest positive value of B is

(a) $\frac{25}{24}\pi$ (b) $\frac{19}{24}\pi$ (c) $\frac{13}{24}\pi$ (d) $\frac{11}{24}\pi$

81. The solution of the equation $\cos^2 x-2\cos x=4\sin x-\sin 2x, (0\le x\le\pi)$ is

(a) $\pi - \cot^{-1}\left(\frac{1}{2}\right)$ (b) $\pi - \tan^{-1}$ [illegible]

(c) $\pi + \tan^{-1}\left(-\frac{1}{2}\right)$ (d) None of these

82. Let $f(x) = \cos\sqrt{x}$, then which of the following is true

(a) $f(x)$ is periodic with period $\sqrt{2\pi}$

(b) $f(x)$ is periodic with period $\sqrt{\pi}$

(c) $f(x)$ is periodic with period $4\pi^2$

(d) $f(x)$ is not a periodic function

83. In a triangle ABC, $\angle B = \frac{\pi}{3}$ and $\angle C = \frac{\pi}{4}$ and D divides BC internally in the ratio 1 : 3. Then $\frac{\sin \angle BAD}{\sin \angle CAD}$ is equal to

(a) $\frac{1}{3}$ (b) $\frac{1}{\sqrt{3}}$

(c) $\frac{1}{\sqrt{6}}$ (d) $\sqrt{\frac{2}{3}}$

84. If $\theta = \sin^{-1} x + \cos^{-1} x - \tan^{-1} x, x \geq 0$, then the smallest interval in which θ lies is given by

(a) $\frac{\pi}{4} \leq \theta \leq \frac{3\pi}{4}$ (b) $0 < \theta < \pi$

(c) $-\frac{\pi}{4} \leq \theta \leq 0$ (d) $\frac{\pi}{4} \leq \theta \leq \frac{\pi}{2}$

85. If $\sin^{-1} x + \sin^{-1} y + \sin^{-1} z = \frac{3\pi}{2}$, then the value of $x^{100} + y^{100} + z^{100} - \frac{9}{x^{101} + y^{101} + z^{101}}$ is equal to

(a) 0 (b) 3 (c) – 3 (d) 9

86. Three vertices of parallelogram taken in order, are (1, 3), (2, 0) and (5, 1). Then its fourth vertex is

(a) (3, 3) (b) (4, 4) (c) (4, 0) (d) (0, –4)

87. The line joining two points $A(2, 0)$ and $B(3, 1)$ is rotated about A in anti-clockwise direction through an angle of 15°. The equation of the line in the new position, is

(a) $\sqrt{3}x - y - 2\sqrt{3} = 0$ (b) $x - \sqrt{3}y - 2 = 0$

(c) $\sqrt{3}x + y - 2\sqrt{3} = 0$ (d) $x + \sqrt{3}y - 2 = 0$

88. In the equation $y - y_1 = m(x - x_1)$ if m and x_1 are fixed and different lines are drawn for different values of y_1, then

(a) the lines will pass through a single point
(b) there will be a set of parallel lines
(c) there will be one line only
(d) none of these

89. The intercept of a line between the coordinate axes is divided by point (– 5, 4) in the ratio 1 : 2. The equation of the line will be

(a) $5x - 8y + 60 = 0$ (b) $8x - 5y + 60 = 0$
(c) $2x - 5y + 30 = 0$ (d) None of these

90. The equation $\sqrt{(x-2)^2 + y^2} + \sqrt{(x+2)^2 + y^2} = 4$ represents a

(a) circle
(b) pair of straight lines
(c) parabola
(d) ellipse

91. The straight line $(x-2) + (y+3) = 0$ cuts the circle $(x-2)^2 + (y-3)^2 = 11$ at

(a) no points (b) one point
(c) two points (d) none of these

92. A circle lies in the second quadrant and touches both the axes. If the radius of the circle be 4, then its equation is

(a) $x^2 + y^2 + 8x + 8y + 16 = 0$ (b) $x^2 + y^2 + 8x - 8y + 16 = 0$
(c) $x^2 + y^2 - 8x + 8y + 16 = 0$ (d) $x^2 + y^2 - 8x - 8y + 16 = 0$

93. The locus of the intersection point of $x\cos\alpha - y\sin\alpha = a$ and $x\sin\alpha - y\cos\alpha = b$ is

(a) ellipse (b) hyperbola
(c) parabola (d) none of these

94. $y^2 - 2x - 2y + 5 = 0$ represents

(a) a circle whose centre is (1, 1) (b) a parabola whose focus is (1, 2)
(c) a parabola whose directrix is $x = \frac{3}{2}$ (d) a parabola whose directrix is $x = -\frac{1}{2}$

95. The curve described parametrically by $x = t^2 + t + 1.$ $y = t^2 - t + 1$ represents

(a) a pair of straight lines (b) an ellipse
(c) a parabola (d) a hyperbola

96. If the module of the vectors $\vec{a}, \vec{b}, \vec{c}$ are 3, 4, 5 respectively and $\vec{a}$ and $\vec{b}+\vec{c}$, $\vec{b}$ and $\vec{c}+\vec{a}$, $\vec{c}$ and $\vec{a}+\vec{b}$ are mutually perpendicular, then the modulus of $\vec{a}+\vec{b}+\vec{c}$ is

(a) $\sqrt{12}$ (b) 12

(c) $5\sqrt{2}$ (d) 50

97. What will be the length of longer diagonal of the parallelogram constructed on $5\vec{a}+2\vec{b}$ and $\vec{a}-3\vec{b}$, if it is given that $|\vec{a}|=2\sqrt{2}, |\vec{b}|=3$ and angle between $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{4}$

(a) 15 (b) $\sqrt{113}$

(c) $\sqrt{593}$ (d) $\sqrt{369}$

98 Image point of (5, 4, 6) in the plane $x+y+2z-15=0$ is

(a) (3, 2, 2) (b) (2, 3, 2)

(c) (2, 2, 3) (d) (–5, –4, –6)

99. If a line makes angles α, β, γ, δ with the four diagonals of a cube, then the value of $\cos^2\alpha+\cos^2\beta+\cos^2\gamma+\cos^2\delta$ is equal to

(a) 1 (b) 4/3

(c) Variable (d) none of these

100. Suppose $f(x)=(x+1)^2$ for $x\geq -1$. If $g(x)$ is the function whose graph is the reflection of the graph of $f(x)$ with respect to the line $y=x$, then $g(x)$ equals

(a) $-\sqrt{x}-1, x\geq 0$ (b) $\frac{1}{(x+1)^2}, x>-1$

(c) $\sqrt{x+1}, x\geq -1$ (d) $\sqrt{x}-1, x\geq 0$