1. Two coins are tossed. Let A be the event that the first coin shows head and B be the event that the second coin shows a tail. Two events A and B are
(a) Mutually exclusive
(b) Dependent
(c) Independent and mutually exclusive
(d) None of these

2. If $P(A_1 \cup A_2) = 1 - P(A_1^c)P(A_2^c)$ where c stands for complement, then the events A_1 and A_2 are
(a) Mutually exclusive (b) Independent
(c) Equally likely (d) None of these

3. Two fair dice are tossed. Let A be the event that the first die shows an even number and B be the event that the second die shows an odd number. The two event A and B are
(a) Mutually exclusive
(b) Independent and mutually exclusive
(c) Dependent
(d) None of these

4. In a box of 10 electric bulbs, two are defective. Two bulbs are selected at random one after the other from the box. The first bulb after selection being put back in the box before making the second selection. The probability that both the bulbs are without defect is
(a) $\frac{9}{25}$ (b) $\frac{16}{25}$
(c) $\frac{4}{5}$ (d) $\frac{8}{25}$

5. A fair coin is tossed n times. If the probability that head occurs 6 times is equal to the probability that head occurs 8 times, then n is equal to
(a) 15 (b) 14
(c) 12 (d) 7

6. If A and B are two events such that $P(A) = \frac{3}{8}$, $P(B) = \frac{5}{8}$ and $P(A \cup B) = \frac{3}{4}$, then $P\left(\frac{A}{B}\right) =$
(a) $\frac{2}{5}$ (b) $\frac{2}{3}$
(c) $\frac{3}{5}$ (d) None of these

7. If **a**, **b**, **c** are mutually perpendicular unit vectors, then $|\mathbf{a} + \mathbf{b} + \mathbf{c}| =$
(a) $\sqrt{3}$ (b) 3
(c) 1 (d) 0

8. If $|\mathbf{a}| + |\mathbf{b}| = |\mathbf{c}|$ and $\mathbf{a} + \mathbf{b} = \mathbf{c}$, then the angle between **a** and **b** is
(a) $\frac{\pi}{2}$ (b) π
(c) 0 (d) None of these

9. If **a** has magnitude 5 and points north-east and vector **b** has magnitude 5 and points north-west, then $|\mathbf{a} - \mathbf{b}| =$
(a) 25 (b) 5
(c) $7\sqrt{3}$ (d) $5\sqrt{2}$

10. If θ be the angle between the unit vectors **a** and **b,** then $\cos\frac{\theta}{2} =$
(a) $\frac{1}{2}|\mathbf{a} - \mathbf{b}|$ (b) $\frac{1}{2}|\mathbf{a} + \mathbf{b}|$
(c) $\frac{|\mathbf{a} - \mathbf{b}|}{|\mathbf{a} + \mathbf{b}|}$ (d) $\frac{|\mathbf{a} + \mathbf{b}|}{|\mathbf{a} - \mathbf{b}|}$

11. Which of the following is not a property of vectors
(a) $\mathbf{u} \times \mathbf{v} = \mathbf{v} \times \mathbf{u}$
(b) $\mathbf{u} . \mathbf{v} = \mathbf{v} . \mathbf{u}$
(c) $(\mathbf{u} \times \mathbf{v})^2 = \mathbf{u}^2 . \mathbf{v}^2 - (\mathbf{u} . \mathbf{v})^2$
(d) $\mathbf{u}^2 = |\mathbf{u}|^2$

12. The number of vectors of unit length perpendicular to vectors $\mathbf{a} = (1, 1, 0)$ and $\mathbf{b} = (0, 1, 1)$ is
(a) Three (b) One
(c) Two (d) Infinite

13. If $\mathbf{a} = (1, -1, 1)$ and $\mathbf{c} = (-1, -1, 0)$, then the vector **b** satisfying $\mathbf{a} \times \mathbf{b} = \mathbf{c}$ and $\mathbf{a} . \mathbf{b} = 1$ is
(a) (1, 0, 0) (b) (0, 0, 1)
(c) (0, –1, 0) (d) None of these

14. If $\mathbf{a} \times \mathbf{b} = \mathbf{b} \times \mathbf{c} \neq 0$, where **a, b** and **c** are coplanar vectors, then for some scalar k
(a) $\mathbf{a} + \mathbf{c} = k\,\mathbf{b}$ (b) $\mathbf{a} + \mathbf{b} = k\,\mathbf{c}$
(c) $\mathbf{b} + \mathbf{c} = k\,\mathbf{a}$ (d) None of these

15. If $\mathbf{a} \neq \mathbf{0}$, $\mathbf{b} \neq \mathbf{0}$, $\mathbf{c} \neq \mathbf{0}$, then true statement is
(a) $\mathbf{a} \times (\mathbf{b} + \mathbf{c}) = (\mathbf{c} + \mathbf{b}) \times \mathbf{a}$ (b) $\mathbf{a} . (\mathbf{b} + \mathbf{c}) = -(\mathbf{b} + \mathbf{c}) . \mathbf{a}$
(c) $\mathbf{a} \times (\mathbf{b} - \mathbf{c}) = (\mathbf{c} - \mathbf{b}) \times \mathbf{a}$ (d) $\mathbf{a} . (\mathbf{b} - \mathbf{c}) = (\mathbf{c} - \mathbf{b}) . \mathbf{a}$

16. The line $\frac{x+3}{3} = \frac{y-2}{-2} = \frac{z+1}{1}$ and the plane $4x + 5y + 3z - 5 = 0$ intersect at a point
(a) (3, 1, –2) (b) (3, – 2, 1)
(c) (2, –1, 3) (d) (–1, –2, –3)

17. If 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

18. The equation of plane through the line of intersection of planes $ax+by+cz+d=0$, $a'x+b'y+c'z+d'=0$ and parallel to the line $y=0, z=0$ is

(a) $(ab'-a'b)x+(bc'-b'c)y+(ad'-a'd)=0$

(b) $(ab'-a'b)x+(bc'-b'c)y+(ad'-a'd)z=0$

(c) $(ab'-a'b)y+(ac'-a'c)z+(ad'-a'd)=0$

(d) None of these

19. The equation of the plane which bisects the line joining (2, 3, 4) and (6, 7, 8) is

(a) $x+y+z-15=0$ (b) $x-y+z-15=0$

(c) $x-y-z-15=0$ (d) $x+y+z+15=0$

20. The line $\frac{x-2}{3}=\frac{y-3}{4}=\frac{z-4}{5}$ is parallel to the plane

(a) $2x+3y+4z=29$ (b) $3x+4y-5z=10$

(c) $3x+4y+5z=38$ (d) $x+y+z=0$

21. The distance between the line $\frac{x-1}{3}=\frac{y+2}{-2}=\frac{z-1}{2}$ and the plane $2x+2y-z=6$ is

(a) 9 (b) 1

(c) 2 (d) 3

22. A class has 175 students. The following data shows the number of students obtaining one or more subjects. Mathematics 100, Physics 70, Chemistry 40; Mathematics and Physics 30, Mathematics and Chemistry 28, Physics and Chemistry 23; Mathematics, Physics and Chemistry 18. How many students have offered Mathematics alone

(a) 35 (b) 48

(c) 60 (d) 22

23. Consider the following relations :

(1) $A-B=A-(A\cap B)$

(2) $A=(A\cap B)\cup(A-B)$

(3) $A-(B\cup C)=(A-B)\cup(A-C)$

which of these is/are correct

(a) 1 and 3 (b) 2 only

(c) 2 and 3 (d) 1 and 2

24. If two sets A and B are having 99 elements in common, then the number of elements common to each of the sets $A\times B$ and $B\times A$ are

(a) 2^{99} (b) 99^2

(c) 100 (d) 18

25. Given $n(U)=20$, $n(A)=12$, $n(B)=9$, $n(A\cap B)=4$, where U is the universal set, A and B are subsets of U, then $n((A\cup B)^C)=$

(a) 17 (b) 9

(c) 11 (d) 3

26. Let A = {1, 2, 3, 4} and let R = {(2, 2), (3, 3), (4, 4), (1, 2)} be a relation on A. Then R is

(a) Reflexive (b) Symmetric

(c) Transitive (d) None of these

27. The void relation on a set A is

(a) Reflexive

(b) Symmetric and transitive

(c) Reflexive and symmetric

(d) Reflexive and transitive

28. Let R_1 be a relation defined by $R_1=\{(a,b)\mid a\geq b, a,b\in R\}$. Then R_1 is

(a) An equivalence relation on R

(b) Reflexive, transitive but not symmetric

(c) Symmetric, Transitive but not reflexive

(d) Neither transitive not reflexive but symmetric

29. Which one of the following relations on R is an equivalence relation

(a) $aR_1b \Leftrightarrow |a|=|b|$ (b) $aR_2b \Leftrightarrow a\geq b$

(c) $aR_3b \Leftrightarrow a$ divides b (d) $aR_4b \Leftrightarrow a<b$

30. N characters of information are held on magnetic tape, in batches of x characters each; the batch processing time is $\alpha+\beta x^2$ seconds; α and β are constants. The optimal value of x for fast processing is

(a) $\frac{\alpha}{\beta}$ (b) $\frac{\beta}{\alpha}$

(c) $\sqrt{\frac{\alpha}{\beta}}$ (d) $\sqrt{\frac{\beta}{\alpha}}$

31. On the interval [0, 1], the function $x^{25}(1-x)^{75}$ takes its maximum value at the point

(a) 0 (b) 1/2

(c) 1/3 (d) 1/4

32. The function $f(x)=\int_{-1}^{x} t(e^t-1)(t-1)(t-2)^3(t-3)^5dt$ has a local minimum at x =
(a) 0 (b) 1
(c) 2 (d) 3

33. $\sin[\cot^{-1}(\cos\tan^{-1}x)]=$
(a) $\frac{x}{\sqrt{x^2+2}}$ (b) $\frac{x}{\sqrt{x^2+1}}$
(c) $\frac{1}{\sqrt{x^2+2}}$ (d) $\sqrt{\frac{x^2+1}{x^2+2}}$

34. If $\sin(\cot^{-1}(x+1)=\cos(\tan^{-1}x)$, then x =
(a) $-\frac{1}{2}$ (b) $\frac{1}{2}$
(c) 0 (d) $\frac{9}{4}$

35. $\cos^{-1}\frac{4}{5}+\tan^{-1}\frac{3}{5}=$
(a) $\tan^{-1}\frac{27}{11}$ (b) $\sin^{-1}\frac{11}{27}$
(c) $\cos^{-1}\frac{11}{27}$ (d) None of these

36. If $x+\frac{1}{x}=2\cos\alpha$, then $x^n+\frac{1}{x^n}=$
(a) $2^n\cos\alpha$ (b) $2^n\cos n\alpha$
(c) $2i\sin n\alpha$ (d) $2\cos n\alpha$

37. If $\cos\theta=\frac{1}{2}\left(x+\frac{1}{x}\right)$, then $\frac{1}{2}\left(x^2+\frac{1}{x^2}\right)=$
(a) $\sin 2\theta$ (b) $\cos 2\theta$
(c) $\tan 2\theta$ (d) $\sec 2\theta$

38. The value of $e^{\log_{10}\tan 1^\circ+\log_{10}\tan 2^\circ+\log_{10}\tan 3^\circ+..........+\log_{10}\tan 89^\circ}$ is
(a) 0 (b) e
(c) 1/e (d) None of these

39. $\cot x-\tan x=$
(a) $\cot 2x$ (b) $2\cot^2 x$
(c) $2\cot 2x$ (d) $\cot^2 2x$

40. $\frac{1+\sin A-\cos A}{1+\sin A+\cos A}=$
(a) $\sin\frac{A}{2}$ (b) $\cos\frac{A}{2}$
(c) $\tan\frac{A}{2}$ (d) $\cot\frac{A}{2}$

41. If $A+B+C=\pi\ (A,B,C>0)$ and the angle C is obtuse then
(a) $\tan A\tan B>1$ (b) $\tan A\tan B<1$
(c) $\tan A\ \tan B=1$ (d) None of these

42. If A, B, C are acute positive angles such that $A+B+C=\pi$ and $\cot A\cot B\cot C=K$, then
(a) $K\le\frac{1}{3\sqrt{3}}$ (b) $K\ge\frac{1}{3\sqrt{3}}$
(c) $K<\frac{1}{9}$ (d) $K>\frac{1}{3}$

43. If $A+B+C=\frac{3\pi}{2}$, then $\cos 2A+\cos 2B+\cos 2C=$
(a) $1-4\cos A\cos B\cos C$ (b) $4\sin A\ \sin B\ \sin C$
(c) $1+2\cos A\cos B\cos C$ (d) $1-4\sin A\ \sin B\ \sin C$

44. Maximum value of $f(x)=\sin x+\cos x$ is
(a) 1 (b) 2
(c) $\frac{1}{\sqrt{2}}$ (d) $\sqrt{2}$

45. In the graph of the function $\sqrt{3}\sin x+\cos x$ the maximum distance of a point from x-axis is
(a) 4 (b) 2
(c) 1 (d) $\sqrt{3}$

46. $\frac{d}{dx}(e^x\log\sin 2x)=$
(a) $e^x(\log\sin 2x+2\cot 2x)$ (b) $e^x(\log\cos 2x+2\cot 2x)$
(c) $e^x(\log\cos 2x+\cot 2x)$ (d) None of these

47. $\frac{d}{dx}\tan^{-1}\frac{4\sqrt{x}}{1-4x}=$
(a) $\frac{1}{\sqrt{x}(1+4x)}$ (b) $\frac{2}{\sqrt{x}(1+4x)}$
(c) $\frac{4}{\sqrt{x}(1+4x)}$ (d) None of these

48. If $y=\sin[\cos(\sin x)]$, then $dy/dx=$
(a) $-\cos[\cos(\sin x)]\sin(\cos x).\cos x$
(b) $-\cos[\cos(\sin x)]\sin(\sin x).\cos x$
(c) $\cos[\cos(\sin x)]\sin(\cos x).\cos x$
(d) $\cos[\cos(\sin x)]\sin(\sin x).\cos x$

49. If $y=\sec^{-1}\left(\frac{\sqrt{x}+1}{\sqrt{x}-1}\right)+\sin^{-1}\left(\frac{\sqrt{x}-1}{\sqrt{x}+1}\right)$, then $\frac{dy}{dx}=$
(a) 0 (b) $\frac{1}{\sqrt{x}+1}$
(c) 1 (d) None of these

50. $\frac{d}{dx}\sin^{-1}(3x-4x^3)=$
(a) $\frac{3}{\sqrt{1-x^2}}$ (b) $\frac{-3}{\sqrt{1-x^2}}$
(c) $\frac{1}{\sqrt{1-x^2}}$ (d) $\frac{-1}{\sqrt{1-x^2}}$

51. If $y = e^{x+e^{x+e^{x+....\infty}}}$, then $\frac{dy}{dx} =$

(a) $\frac{y}{1-y}$ (b) $\frac{1}{1-y}$

(c) $\frac{y}{1+y}$ (d) $\frac{y}{y-1}$

52. If $x^y = e^{x-y}$, then $\frac{dy}{dx} =$

(a) $\log x.[\log(ex)]^{-2}$ (b) $\log x.[\log(ex)]^2$

(c) $\log x.(\log x)^2$ (d) None of these

53. If two forces P and Q act on such an angle that their resultant force R is equal to force P, then if P is doubled then the angle between new resultant force and Q will be

(a) 30^o (b) 60^o

(c) 45^o (d) 90^o

54. A bead of weight W can slide on a smooth circular wire in a vertical plane, the bead is attached by a light thread to the highest point of the wire, and in equilibrium the thread is taut. Then the tension of the thread and the reaction of the wire on the bead, if the length of the string is equal to the radius of the wire, are

(a) $W, 2W$ (b) W, W

(c) $W, 3W$ (d) None of these

55. The resultant of two forces P and Q is R. If the direction of P is reversed keeping the direction Q same, the resultant remains unaltered. The angle between P and Q is

(a) 90° (b) 60°

(c) 45° (d) 30°

56. A solid cone of semi- vertical angle θ is placed on a rough inclined plane. If the inclination of the plane is increased slowly and $\mu < 4\ \tan\theta$, then

(a) Cone will slide down before toppling

(b) Cone will topple before sliding down

(c) Cone will slide and topple simultaneously

(d) Cone will rest in limiting equilibrium

57. A circular cylinder of radius r and height h rests on a rough horizontal plane with one of its flat ends on the plane. A gradually increasing horizontal force is applied through the centre of the upper end. If the coefficient of friction is μ, the cylinder will topple before sliding, if

(a) $r < \mu h$ (b) $r \geq \mu h$

(c) $r \geq 2\mu h$ (d) $r = 2\mu h$

58. A uniform beam AB of weight W is standing with the end B on a horizontal floor and end A leaning against a vertical wall. The beam stands in a vertical plane perpendicular to the wall inclined at 45^o to the vertical, and is in the position of limiting equilibrium. If the two points of contact are equally rough, then the coefficient of friction at each of them is

(a) $\sqrt{2}-1$ (b) $\frac{1}{\sqrt{2}}$

(c) $\frac{1}{\sqrt{3}}$ (d) None of these

59. A body is pulled up an inclined rough plane. Let λ be the angle of friction. The required force is least when it makes an angle $k\lambda$ with the inclined plane, where $k =$

(a) $\frac{1}{3}$ (b) $\frac{1}{2}$

(c) 1 (d) 2

60. Which of the following differential equations has the same order and degree

(a) $\frac{d^4y}{dx^4} + 8\left(\frac{dy}{dx}\right)^6 + 5y = e^x$

(b) $5\left(\frac{d^3y}{dx^3}\right)^4 + 8\left(1+\frac{dy}{dx}\right)^2 + 5y = x^8$

(c) $\left[1+\left(\frac{dy}{dx}\right)^3\right]^{2/3} = 4\frac{d^3y}{dx^3}$

(d) $y = x^2\frac{dy}{dx} + \sqrt{1+\left(\frac{dy}{dx}\right)^2}$

61. $y = 4\sin 3x$ is a solution of the differential equation

(a) $\frac{dy}{dx} + 8y = 0$ (b) $\frac{dy}{dx} - 8y = 0$

(c) $\frac{d^2y}{dx^2} + 9y = 0$ (d) $\frac{d^2y}{dx^2} - 9y = 0$

62. The differential equation of all the lines in the xy-plane is

(a) $\frac{dy}{dx} - x = 0$ (b) $\frac{d^2y}{dx^2} - x\frac{dy}{dx} = 0$

(c) $\frac{d^2y}{dx^2} = 0$ (d) $\frac{d^2y}{dx^2} + x = 0$

63. The solution of the differential equation $x\cos y dy = (xe^x \log x + e^x)dx$ is

(a) $\sin y = \frac{1}{x}e^x + c$ (b) $\sin y + e^x \log x + c = 0$

(c) $\sin y = e^x \log x + c$ (d) None of these

64. The solution of the equation $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$ is

(a) $e^y = e^x + \frac{x^3}{3} + c$ (b) $e^y = e^x + 2x + c$

(c) $e^y = e^x + x^3 + c$ (d) $y = e^x + c$

65. The solution of the differential equation $\frac{dy}{dx} + \frac{1+x^2}{x} = 0$ is

(a) $y = -\frac{1}{2}\tan^{-1}x + c$ (b) $y + \log x + \frac{x^2}{2} + c = 0$

(c) $y = \frac{1}{2}\tan^{-1}x + c$ (d) $y - \log x - \frac{x^2}{2} = c$

66. The value of $2^n\{1.3.5.....(2n-3)(2n-1)\}$ is

(a) $\frac{(2n)!}{n!}$ (b) $\frac{(2n)!}{2^n}$

(c) $\frac{n!}{(2n)!}$ (d) None of these

67. A question paper is divided into two parts A and B and each part contains 5 questions. The number of ways in which a candidate can answer 6 questions selecting at least two questions from each part is

(a) 80 (b) 100

(c) 200 (d) None of these

68. The value of $\int_0^{\pi/2} \frac{\sin x}{1+\cos^2 x} dx$ is

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

(c) $\pi/3$ (d) $\pi/6$

69. The value of $\int_1^2 \log x\, dx$ is

(a) $\log 2/e$ (b) $\log 4$

(c) $\log 4/e$ (d) $\log 2$

70. The area enclosed by the parabola $y^2 = 4ax$ and the straight line $y = 2ax$, is

(a) $\frac{a^2}{3}$ sq. unit (b) $\frac{1}{3a^2}$ sq. unit

(c) $\frac{1}{3a}$ sq. unit (d) $\frac{2}{3a}$ sq. unit

71. If $x^2 + 6x + 20y - 51 = 0$, then axis of parabola is

(a) $x + 3 = 0$ (b) $x - 3 = 0$

(c) $x = 1$ (d) $x + 1 = 0$

72. The equation of the tangent to the parabola $y = x^2 - x$ at the point where $x = 1$, is

(a) $y = -x - 1$ (b) $y = -x + 1$

(c) $y = x + 1$ (d) $y = x - 1$

73. The eccentricity of the conic $4x^2 + 16y^2 - 24x - 3y = 1$ is

(a) $\frac{\sqrt{3}}{2}$ (b) $\frac{1}{2}$

(c) $\frac{\sqrt{3}}{4}$ (d) $\sqrt{3}$

74. If the line $y = 2x + c$ be a tangent to the ellipse $\frac{x^2}{8} + \frac{y^2}{4} = 1$, then $c =$

(a) ± 4 (b) ± 6

(c) ± 1 (d) ± 8

75. The equation of the normal to the hyperbola $\frac{x^2}{16} - \frac{y^2}{9} = 1$ at the point $(8, 3\sqrt{3})$ is

(a) $\sqrt{3}x + 2y = 25$ (b) $x + y = 25$

(c) $y + 2x = 25$ (d) $2x + \sqrt{3}y = 25$

76. The equation of the normal at the point (6, 4) on the hyperbola $\frac{x^2}{9} - \frac{y^2}{16} = 3$, is

(a) $3x + 8y = 50$ (b) $3x - 8y = 50$

(c) $8x + 3y = 50$ (d) $8x - 3y = 50$

77. The angle of elevation of the top of a tower at point on the ground is 30°. If on walking 20 metres toward the tower, the angle of elevation become 60°, then the height of the tower is

(a) 10 metre (b) $\frac{10}{\sqrt{3}}$ *metre*

(c) $10\sqrt{3}$ *metre* (d) None of these

78. The angle of elevation of a tower at a point distant d meters from its base is 30°. If the tower is 20 meters high, then the value of d is

(a) $10\sqrt{3}m$ (b) $\frac{20}{\sqrt{3}}m$

(c) $20\sqrt{3}m$ (d) $10\,m$

79. $\int \sec^4 x \tan x\, dx =$

(a) $\frac{1}{4}\sec^4 x + c$ (b) $4\sec^4 x + c$

(c) $\frac{\sec^3 x}{3} + c$ (d) $3\sec^3 x + c$

80. $\int e^{-x}\text{cosec}^2(2e^{-x}+5)\, dx =$

(a) $\frac{1}{2}\cot(2e^{-x}+5) + c$ (b) $-\frac{1}{2}\cot(2e^{-x}+5) + c$

(c) $2\cot(2e^{-x}+5) + c$ (d) $-2\cot(2e^{-x}+5) + c$

81. The value of k for which the equation $(k-2)x^2+8x+k+4=0$ has both real, distinct and negative is

(a) 0 (b) 2
(c) 3 (d) – 4

82. If $k \in (-\infty, -2) \cup (2, \infty)$, then the roots of the equation $x^2+2kx+4=0$ are

(a) Complex
(b) Real and unequal
(c) Real and equal
(d) One real and one imaginary

83. If the equation $(m-n)x^2+(n-l)x+l-m=0$ has equal roots, then l, m and n satisfy

(a) $2l=m+n$ (b) $2m=n+l$
(c) $m=n+l$ (d) $l=m+n$

84. The least integer k which makes the roots of the equation $x^2+5x+k=0$ imaginary is

(a) 4 (b) 5
(c) 6 (d) 7

85. The roots of $4x^2+6px+1=0$ are equal, then the value of p is

(a) $\frac{4}{5}$ (b) $\frac{1}{3}$
(c) $\frac{2}{3}$ (d) $\frac{4}{3}$

86. The value of k for which one of the roots of $x^2-x+3k=0$ is double of one of the roots of $x^2-x+k=0$ is

(a) 1 (b) – 2
(c) 2 (d) None of these

87. Let α, β be the roots of $x^2-x+p=0$ and γ, δ be the roots of $x^2-4x+q=0$. If $\alpha, \beta, \gamma, \delta$ are in G.P., then integral values of p, q are respectively

(a) – 2, – 32 (b) – 2, 3
(c) – 6, 3 (d) – 6, – 32

88. If A.M. of the roots of a quadratic equation is 8/5 and A.M. of their reciprocals is 8/7, then the equation is

(a) $5x^2-16x+7=0$ (b) $7x^2-16x+5=0$
(c) $7x^2-16x+8=0$ (d) $3x^2-12x+7=0$

89. If $1-i$ is a root of the equation $x^2-ax+b=0$, then $b=$

(a) – 2 (b) – 1
(c) 1 (d) 2

90. If $a_1, a_2, a_3, ...a_{24}$ are in arithmetic progression and $a_1+a_5+a_{10}+a_{15}+a_{20}+a_{24}=225$, then $a_1+a_2+a_3+........+a_{23}+a_{24}=$

(a) 909 (b) 75
(c) 750 (d) 900

91. If the roots of the equation $x^3-12x^2+39x-28=0$ are in A.P., then their common difference will be

(a) ±1 (b) ±2
(c) ±3 (4) ±4

92. If the first term of a G.P. $a_1, a_2, a_3, ...$ is unity such that $4a_2+5a_3$ is least, then the common ratio of G.P. is

(a) $-\frac{2}{5}$ (b) $-\frac{3}{5}$
(c) $\frac{2}{5}$ (d) None of these

93. The angle between the lines joining the points of intersection of line $y=3x+2$ and the curve $x^2+2xy+3y^2+4x+8y-11=0$ to the origin, is

(a) $\tan^{-1}\left(\frac{3}{2\sqrt{2}}\right)$ (b) $\tan^{-1}\left(\frac{2\sqrt{2}}{3}\right)$
(c) $\tan^{-1}(\sqrt{3})$ (d) $\tan^{-1}(2\sqrt{2})$

94. If the lines $ax^2+2hxy+by^2=0$ represents the adjacent sides of a parallelogram, then the equation of second diagonal if one is $lx+my=1$, will be

(a) $(am+hl)x=(bl+hm)y$ (b) $(am-hl)x=(bl-hm)y$
(c) $(am-hl)x=(bl+hm)y$ (d) None of these

95. If the pair of lines $ax^2+2(a+b)xy+by^2=0$ lie along diameters of a circle and divide the circle into four sectors such that the area of one of the sectors is thrice the area of another sector then

(a) $3a^2+10ab+3b^2=0$ (b) $3a^2+2ab+3b^2=0$
(c) $3a^2-10ab+3b^2=0$ (d) $3a^2-2ab+3b^2=0$

96. The distance of the point $(b\cos\theta, b\sin\theta)$ from origin is

(a) $b\cot\theta$ (b) b
(c) $b\tan\theta$ (d) $b\sqrt{2}$

97. The distance of the middle point of the line joining the points $(a\sin\theta, 0)$ and $(0, a\cos\theta)$ from the origin is

(a) $\frac{a}{2}$ (b) $\frac{1}{2}a(\sin\theta+\cos\theta)$
(c) $a(\sin\theta+\cos\theta)$ (d) a

98. The line $3x+2y=24$ meets y-axis at A and x-axis at B. The perpendicular bisector of AB meets the line through $(0,-1)$ parallel to x-axis at C. The area of the triangle ABC is

(a) $182 sq.$ units (b) $91 sq.$ units
(c) $48 sq.$ units (d) None of these

99. A pair of straight lines drawn through the origin form with the line $2x+3y=6$ an isosceles right angled triangle, then the lines and the area of the triangle thus formed is

(a) $x-5y=0$, $5x+y=0$, $\Delta=\frac{36}{13}$ (b) $3x-y=0$, $x+3y=0$, $\Delta=\frac{12}{17}$
(c) $5x-y=0$, $x+5y=0$, $\Delta=\frac{13}{5}$ (d) None of these

100. The diagonals of a parallelogram $PQRS$ are along the lines $x+3y=4$ and $6x-2y=7$. Then $PQRS$ must be a

(a) Rectangle (b) Square
(c) Cyclic quadrilateral (d) Rhombus

101. If $\cos\alpha+\cos\beta+\cos\gamma=\sin\alpha+\sin\beta+\sin\gamma=0$ then $\cos 3\alpha+\cos 3\beta+\cos 3\gamma$ equals to

(a) 0 (b) $\cos(\alpha+\beta+\gamma)$
(c) $3\cos(\alpha+\beta+\gamma)$ (d) $3\sin(\alpha+\beta+\gamma)$

102. If $z_r=\cos\frac{r\alpha}{n^2}+i\sin\frac{r\alpha}{n^2}$, where r = 1, 2, 3,….,n, then $\lim_{n\to\infty} z_1z_2z_3...z_n$ is equal to

(a) $\cos\alpha+i\sin\alpha$ (b) $\cos(\alpha/2)-i\sin(\alpha/2)$
(c) $e^{i\alpha/2}$ (d) $\sqrt[3]{e^{i\alpha}}$

103. If the cube roots of unity be $1,\omega,\omega^2$, then the roots of the equation $(x-1)^3+8=0$ are

(a) $-1,1+2\omega,1+2\omega^2$ (b) $-1,1-2\omega,1-2\omega^2$
(c) $-1,-1,-1$ (d) None of these

104. If $1,\omega,\omega^2,\omega^3.......,\omega^{n-1}$ are the n,n^{th} roots of unity, then $(1-\omega)(1-\omega^2).....(1-\omega^{n-1})$ equals

(a) 0 (b) 1
(c) n (d) n^2

105. At the point $x=1$, the given function $f(x)=\begin{cases}x^3-1; 1<x<\infty\\ x-1; -\infty<x\le 1\end{cases}$ is

(a) Continuous and differentiable
(b) Continuous and not differentiable
(c) Discontinuous and differentiable
(d) Discontinuous and not differentiable

106. Which of the following function is even function

(a) $f(x)=\frac{a^x+1}{a^x-1}$ (b) $f(x)=x\left(\frac{a^x-1}{a^x+1}\right)$
(c) $f(x)=\frac{a^x-a^{-x}}{a^x+a^{-x}}$ (d) $f(x)=\sin x$

107. If $f(x)=\log\frac{1+x}{1-x}$, then $f(x)$ is

(a) Even function (b) $f(x_1)f(x_2)=f(x_1+x_2)$
(c) $\frac{f(x_1)}{f(x_2)}=f(x_1-x_2)$ (d) Odd function

108. $\lim_{x\to a}\frac{(x^{-1}-a^{-1})}{x-a}=$

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

109. $\lim_{x\to\infty}\left(\frac{x+2}{x+1}\right)^{x+3}$ is

(a) 1 (b) e
(c) e^2 (d) e^3

110. The function defined by $f(x)=\begin{cases}\left(x^2+e^{\frac{1}{2-x}}\right)^{-1}, & x\ne 2\\ k, & x=2\end{cases}$, is continuous from right at the point x = 2, then k is equal to

(a) 0 (b) 1/4
(c) –1/4 (d) None of these

111. For the function $f(x)=\frac{\log_e(1+x)-\log_e(1-x)}{x}$ to be continuous at $x=0$, the value of $f(0)$, should be

(a) –1 (b) 0
(c) –2 (d) 2

112. Let L_1 be a straight line passing through the origin and L_2 be the straight line $x+y=1$. If the intercepts made by the circle $x^2+y^2-x+3y=0$ on L_1 and L_2 are equal, then which of the following equations can represent L_1

(a) $x+y=0$ (b) $x-y=0$

(c) $x+7y=0$ (d) $x-7y=0$

113. The area of the triangle formed by joining the origin to the points of intersection of the line $x\sqrt{5}+2y=3\sqrt{5}$ and circle $x^2+y^2=10$ is

(a) 3 (b) 4

(c) 5 (d) 6

114. The sum of the coefficients in the expansion of $(x+y)^n$ is 4096. The greatest coefficient in the expansion is

(a) 1024 (b) 924

(c) 824 (d) 724

115. If the sum of the coefficients in the expansion of $(\alpha x^2-2x+1)^{35}$ is equal to the sum of the coefficients in the expansion of $(x-\alpha y)^{35}$, then α =

(a) 0

(b) 1

(c) May be any real number

(d) No such value exist

116. In a ΔABC, if $\begin{vmatrix} 1 & a & b \\ 1 & c & a \\ 1 & b & c \end{vmatrix}=0$, then

$\sin^2 A+\sin^2 B+\sin^2 C=$

(a) $\frac{9}{4}$ (b) $\frac{4}{9}$

(c) 1 (d) $3\sqrt{3}$

117. For positive numbers x, y and z the numerical value of the determinant $\begin{vmatrix} 1 & \log_x y & \log_x z \\ \log_y x & 1 & \log_y z \\ \log_z x & \log_z y & 1 \end{vmatrix}$ is

(a) 0 (b) 1

(c) $\log_e xyz$ (d) None of these

118. l, m, n are the p^{th}, q^{th} and r^{th} term of a G.P., all positive, then $\begin{vmatrix} \log l & p & 1 \\ \log m & q & 1 \\ \log n & r & 1 \end{vmatrix}$ equals

(a) –1 (b) 2

(c) 1 (d) 0

119. If $x^a y^b=e^m, x^c y^d=e^n, \Delta_1=\begin{vmatrix} m & b \\ n & d \end{vmatrix}, \Delta_2=\begin{vmatrix} a & m \\ c & n \end{vmatrix}$ and $\Delta_3=\begin{vmatrix} a & b \\ c & d \end{vmatrix}$, then the values of x and y are respectively

(a) Δ_1/Δ_3 and Δ_2/Δ_3

(b) Δ_2/Δ_1 and Δ_3/Δ_1

(c) $\log(\Delta_1/\Delta_3)$ and $\log(\Delta_2/\Delta_3)$

(d) e^{Δ_1/Δ_3} and e^{Δ_2/Δ_3}

120. If a, b, c be positive and not all equal, then the value of the determinant $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ is

(a) –ve (b) + ve

(c) Depends on a, b, c (d) None of these

* * *