PAPER – II

MATHEMATICS

1. If $\log x : \log y : \log z = (y-z) : (z-x) : (x-y)$ then

(a) $x^y . y^z . z^x = 1$ (b) $x^x y^y z^z = 1$

(c) $\sqrt[x]{x}\,\sqrt[y]{y}\,\sqrt[z]{z} = 1$ (d) none of these

2. The value of $\lim\limits_{x\to 0}\left(\dfrac{1+5x^2}{1+3x^2}\right)^{\frac{1}{x^2}}$ is

(a) e^2 (b) e (c) e^{-1} (d) none of these

3. If $f(x) = \dfrac{2-(256-7x)^{1/8}}{(5x+32)^{1/5}-2}$ $(x \neq 0)$ then for f to be continuous everywhere $f(0)$ is equal to

(a) -1 (b) 1 (c) 2^4 (d) none of these

4. If $y = x^y$, then $\dfrac{dy}{dx}$ is equal to

(a) $\dfrac{y^2}{x(1+\log y)}$ (b) $\dfrac{y^2}{x(1-\log y)}$ (c) $\dfrac{y}{x^2(1+\log y)}$ (d) $\dfrac{y}{x^2(1-\log y)}$

5. The points on the curve $y^2 = 4a\left(x + a\sin\dfrac{x}{a}\right)$ at which the tangent is parallel to x-axis, lie on

(a) a straight line (b) a parabola

(c) a circle (d) an ellipse

6. $\displaystyle\int \frac{dx}{1-\cos x-\sin x}$ is equal to

(a) $\log\left|1+\cot\dfrac{x}{2}\right|+c$ (b) $\log\left|1-\tan\dfrac{x}{2}\right|+c$

(c) $\log\left|1-\cot\dfrac{x}{2}\right|+c$ (d) $\log\left|1+\tan\dfrac{x}{2}\right|+c$

7. $\displaystyle\int \operatorname{cosec}^4 x\,dx$ is equal to

(a) $\cot x + \dfrac{\cot^3 x}{3} + c$ (b) $\tan x + \dfrac{\tan^3 x}{3} + c$

(c) $-\cot x - \dfrac{\cot^3 x}{3} + c$ (d) $-\tan x - \dfrac{\tan^3 x}{3} + c$

8. $\displaystyle\int_0^{\pi^2/4} \frac{\sin\sqrt{x}}{\sqrt{x}}\,dx$ is equal to

(a) 2 (b) 1 (c) $\dfrac{\pi}{4}$ (d) $\dfrac{\pi^2}{8}$

9. The order and degree of the differential equation $\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^{1/3}+x^{1/4}=0$ are respectively

(a) 2, 3 (b) 3, 3 (c) 2, 6 (d) 2, 4

10. The smallest positive value of x and y, satisfying $x-y=\frac{\pi}{4}$ and $\cot x+\cot y=2$, are

(a) $x=\frac{\pi}{6},\ y=\frac{5\pi}{2}$ (b) $x=\frac{5\pi}{12},\ y=\frac{\pi}{6}$

(c) $x=\frac{\pi}{3},\ y=\frac{7\pi}{12}$ (d) none of these

11. If $\tan^{-1}x+\tan^{-1}y+\tan^{-1}z=\frac{\pi}{2}$, then $1-xy-yz-zx$ is equal to

(a) 1 (b) 0 (c) –1 (d) 2

12. A tea party is arranged for 16 persons along two sides of a long table with 8 chairs on each side. Four persons wish to sit on one particular and two on the other side. Then number of ways can they be seated is

(a) ${}^8P_4\ {}^8P_2\ 10\,!$ (b) ${}^8C_4\ {}^8C_2\ 10\,!$ (c) ${}^8P_4\ {}^8P_2\ 10$ (d) none of these

13. In a class of 10 students there are 3 girls *A*, *B*, *C*. The number of different ways can they be arranged in a row such that no two of the three girls are consecutive is

(a) $(336)\,7\,!$ (b) $(336)\,10\,!$ (c) $(336)\,8\,!$ (d) none of these

14. If the sum of the coefficient in the expansion of $(a+b)^n$ is 4096, then the greatest coefficient in the expansion is

(a) 924 (b) 792 (c) 1594 (d) none of these

15. If $R=(5\sqrt{6}+14)^{2n+1}$ and $f=R-[R]$, where [.] denotes the greatest integer function, then Rf is equal to

(a) 20^n (b) 20^{2n} (c) 20^{2n+1} (d) none of these

16. The image of the point (3, 8) in the line $x+3y=7$ is

(a) (1, 4) (b) (4, 1) (c) (–1, –4) (d) (–4, –1)

17. If the chord of contact of tangents from a point $P(x_1, y_1)$ to the circle $x^2+y^2=a^2$ touches the circle $(x-a)^2+y^2=a^2$, then the locus of (x_1, y_1) is

(a) a circle (b) a parabola (c) an ellipse (d) a hyperbola

18. The locus of the mid-points of the chords of the parabola $y^2=4ax$ which subtend a right angle at the vertex of the parabola is

(a) $y^2-2ax+8a^2=0$ (b) $y^2+2ax+8a^2=0$

(c) $y^2-2ax-8a^2=0$ (d) none of these

19. The equation $16x^2-3y^2-32x+12y-44=0$ represents a hyperbola, then

(a) the length of transverse axis is $4\sqrt{3}$ (b) the length of conjugate axis is 4

(c) centre is (–1, 2) (d) eccentricity is $\sqrt{\frac{19}{3}}$

20. The sum of the eccentric angles of the feet of the normals drawn from any point to an ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is

(a) π (b) $2n\pi$ (c) $(2n+1)\frac{\pi}{2}$ (d) $(2n+1)\pi$

21. Let $p=1+a+a^2+......,|a|<1$

$q=1+b+b^2+......,|b|<1$, then $1+ab+a^2b^2+......$ is equal to

(a) $\frac{pq}{p+q-1}$ (b) $\frac{pq}{p+q}$ (c) $\frac{pq}{p+q+pq}$ (d) none of these

22. If $f(x)$ is a polynomial function such that $f(a)$ and $f(b)$ are of opposite signs, then between *a* and *b* the equation $f(x)=0$ has

(a) at least one root (b) only one real root

(c) even number of real roots (d) all its roots

23. The equation $\frac{A^2}{x-a}+\frac{B^2}{x-b}+\frac{C^2}{x-c}+.......+\frac{H^2}{x-h}=k$ has

(a) no real root (b) at most one real root

(c) no complex root (d) at most two complex roots

24. The largest set of real values of *x* for which $f(x)=\sqrt{(x+2)(5-x)}-\frac{1}{\sqrt{x^2-4}}$ is a real function, is

(a) $[1, 2]\cup(2, 5]$ (b) (2, 5] (c) [3, 4] (d) none of these

25. For a 3 × 3 matrix *A*, if $|A|=4$, then | adj *A* | is equal to

(a) –4 (b) 4 (c) 16 (d) 64

26. There are ten pairs of shoes in a cupboard, out of which 4 shoes are picked out one by one randomly, then the probability that there is at least one pair is

(a) $\frac{224}{323}$ (b) $\frac{99}{323}$ (c) $\frac{204}{323}$ (d) none of these

27. $(\vec{a}.\vec{i})\vec{i}+(\vec{a}.\vec{j})\vec{j}+(\vec{a}.\vec{k})\vec{k}$ is equal to

(a) $\vec{i}+\vec{j}+\vec{k}$ (b) $\vec{a}$ (c) $3\vec{a}$ (d) none of these

28. The plane *x* = 0 divides the join of (–2, 3, 4) and (1, –2, 3) in the ratio

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

29. The equation of straight line passing through the point of intersection of $ax+by+c=0$ and $a'x+b'y+c'=0$ parallel to the *y*-axis is

(a) $x(ab'-a'b)+(cb'-c'b)=0$ (b) $x(ab'+a'b)+(cb'+c'b)=0$

(c) $y(a'b-ab')+(a'c-ac')=0$ (d) none of these

30. The arithmetic mean of n observations is $\overline{X}$. If the first observation is increased by 1, second by 2 and so on, then new arithmetic mean is

(a) $\overline{X}+n$ (b) $\overline{X}+\frac{1}{2}n$ (c) $\overline{X}+\frac{1}{2}(n+1)$ (d) $\overline{X}+\frac{1}{2}(n-1)$

31. At time t, the distance x cm of a particle moving in a horizontal line is given by $x=4t^2+2t$. The acceleration at t = 0.5 s, is

(a) 8 cm/s^2 (b) 6 cm/s^2 (c) 3 cm/s^2 (d) 2 cm/s^2

32. A relation R is defined on the set N of natural numbers as follows: xRy if and only if $x^2+y^2=25$. Then

(a) $R=\{(3,4),(4,4)\}$ (b) $R^{-1}=\{(3,4),(4,3)\}$

(c) $R=\{(0,5),(3,4),(4,3),(5,0)\}$ (d) none of these

33. If the real valued function $f(x)=\dfrac{a^x-1}{x^n(a^x+1)}$ is even, then n equals

(a) 2 (b) 2/3 (c) 1/4 (d) – 1/3

34. If $z_1=1+2i,\ z_2=2+3i,\ z_3=3+4i,$ then $z_1,\ z_2$ and z_3 represent

(a) equilateral triangle (b) right angled triangle

(c) isosceles triangle (d) none of these

35. If x + 1 is a factor of $x^4+(p-3)x^3-(3p-5)x^2+(2p-9)x$ + 6, then the value of p is

(a) – 4 (b) 0 (c) 4 (d) 2

36. For all positive values of x and y, the value of $\dfrac{(1+x+x^2)(1+y+y^2)}{xy}$ is

(a) < 9 (b) ≤ 9 (c) > 9 (d) ≥ 9

37. The real roots of the equation $7^{\log_7(x^2-4x+5)}=x-1$ are

(a) 1 and 2 (b) 2 and 3 (c) 3 and 4 (d) 4 and 5

38. In an isosceles triangle ABC, the coordinates of the points B and C on the base BC are respectively (2, 1) and (1, 2). If the equation of the line AB is $y=\frac{1}{2}x$, then the equation of the line AC is

(a) $2y=x+3$ (b) $y=2x$ (c) $y=\frac{1}{2}(x-1)$ (d) $y=x-1$

39. Let PQ and RS be tangents at the extremities of diameter PR of a circle of radius r. If PS and RQ intersect at a point X on the circumference of the circle, then $2r$ equals

(a) $\sqrt{PQ\cdot RS}$ (b) $\dfrac{PQ+RS}{2}$ (c) $\dfrac{2PQ+RS}{PQ+RS}$ (d) $\dfrac{\sqrt{PQ^2+RS^2}}{2}$

40. The angle between lines joining the origin to the points of intersection of the line $\sqrt{3}x+y=2$ and the curve $y^2-x^2=4$ is

(a) $\tan^{-1}\left(\frac{2}{\sqrt{3}}\right)$ (b) $\frac{\pi}{6}$ (c) $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$ (d) $\frac{\pi}{2}$

41. The Boolean expression $abc + a' + b' + c'$ simples to

(a) 0 (b) 1 (c) abc (d) $ab + ac + bc$

42. If $f(x), g(x)$ be differentiable functions and $f(1) = g(1) = 2$, then

$\lim_{x \to 1}\left(\frac{f(1)g(x) - f(x)g(1) - f(1) + g(1)}{g(x) - f(x)}\right)$ is equal to

(a) 0 (b) 1 (c) 2 (d) none of these

43. Three faces of an ordinary dice are yellow, two faces are red and one face is blue. The dice is tossed 3 times. The probability that yellow, red and blue faces appear in the first, second and third tosses respectively is

(a) $\frac{1}{36}$ (b) $\frac{1}{6}$ (c) $\frac{1}{30}$ (d) none of these

44. Let $f(x) = \int \frac{x^2 dx}{(1+x^2)(1+\sqrt{1+x^2})}$ and $f(0) = 0$. Then $f(1)$ is

(a) $\log(1+\sqrt{2})$ (b) $\log(1+\sqrt{2}) - \frac{\pi}{4}$ (c) $\log(1+\sqrt{2}) + \frac{\pi}{4}$ (d) none of these

45. The A.M. and variance of 10 observation are 10 and 4 respectively. Later it is observed that one observation was incorrectly read as 8 instead of 18. Then, the correct value of mean and variance are

(a) 20, 9 (b) 20, 14 (c) 11, 9 (d) 11, 5

46. If $\vec{p}, \vec{q}$ are two non-collinear and nonzero vectors such that $(b-c)\vec{p} \times \vec{q} + (c-a)\vec{p} + (a-b)\vec{q} = 0$, where a, b, c are the lengths of the sides of a triangle, then the triangle is

(a) right angled (b) obtuse angled (c) equilateral (d) isosceles

47. Let $f''(x) > 0 \ \forall \ x \in \mathbb{R}$ and $g(x) = f(2-x) + f(4+x)$. Then $g(x)$ is increasing in

(a) $(-\infty, -1)$ (b) $(-\infty, 0)$ (c) $(-1, \infty)$ (d) none of these

48. In [0, 1], Lagrange's Mean value theorem is not applicable to

(a) $f(x) = \begin{cases} \frac{1}{2} - x, & x < \frac{1}{2} \\ \left(\frac{1}{2} - x\right)^2, & x \geq \frac{1}{2} \end{cases}$ (b) $f(x) = \begin{cases} \frac{\sin x}{x}, & x \neq 0 \\ 1, & x = 0 \end{cases}$

(c) $f(x) = x|x|$ (d) $f(x) = |x|$

49. The co-ordinate of the point for minimum value of $z = 7x - 8y$, subject to the conditions $x + y - 20 \leq 0$, $y \geq 5$, $x \geq 0$, $y \geq 0$ is

(a) (20, 0) (b) (15, 5) (c) (0, 5) (d) (0, 20)

50. At $x = \frac{5\pi}{6}$, $2\sin 3x + 3\cos 3x$ has

(a) maximum value (b) minimum value

(c) zero value (d) none of these

51. In triangle ABC if $3a = b + c$, then $\cot\frac{B}{2}\cot\frac{C}{2}$ is equal to

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

52. If $f(x) = \cos(\log x)$, then $f\left(\frac{1}{x}\right)f\left(\frac{1}{y}\right) - \frac{1}{2}\left(f\left(\frac{x}{y}\right) + f(xy)\right)$ is equal to

(a) $\cos(x - y)$ (b) $\log[\cos(x - y)]$

(c) 1 (d) 0

53. $\int_0^{\pi/2} \frac{2^{\sin x}}{2^{\sin x} + 2^{\cos x}}\, dx$ is equal to

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

54. The area bounded by the parabola $y^2 = 8x$ and the latus rectum is

(a) $\frac{16}{3}$ (b) $\frac{23}{3}$ (c) $\frac{32}{3}$ (d) $\frac{16\sqrt{2}}{3}$

55. If $\cos\theta + \sin\theta = \sqrt{2}\cos\theta$, then $\cos\theta - \sin\theta$ is equal to

(a) $\sqrt{2}\sin\theta$ (b) $2\sin\theta$ (c) $-\sqrt{2}\sin\theta$ (d) none of these

56. The straight lines $ax + 5y = 7$ and $4x + by = 5$ intersect at the point $(2, -1)$. The first meets the axis of x in A and the 2nd meets the axis of y in B, then the length of AB is

(a) $\frac{10\sqrt{7}}{6}$ (b) $\frac{13}{6}$ (c) $\frac{\sqrt{149}}{6}$ (d) $\frac{\sqrt{99}}{6}$

57. If $\begin{vmatrix} x^n & x^{n+2} & x^{n+3} \\ y^n & y^{n+2} & y^{n+3} \\ z^n & z^{n+2} & z^{n+3} \end{vmatrix} = (x - y)(y - z)(z - x)\left(\frac{1}{x} + \frac{1}{y} + \frac{1}{z}\right)$, then n equals

(a) 1 (b) -1 (c) 2 (d) -2

58. The slope of a chord of the parabola $y^2 = 4ax$ which is normal at one end and which subtends a right angle at the origin is

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

59. Equation of plane which contains the line $\frac{x-1}{1} = \frac{y-2}{3} = \frac{z-3}{2}$ and which is perpendicular to the plane $2x + 7y + 5z = 2$ is

(a) $x + y + z = 6$ (b) $-x + y + z = 2$ (c) $2x - y + z = 3$ (d) $x - y + z = 2$

60. If $|z| < \sqrt{2} - 1$, then $|z^2 + 2z\cos\alpha|$ is

(a) less than 1 (b) $(\sqrt{2}-1)^2$

(c) $\sqrt{2}-1$ (d) none of these

61. Coefficient of x^n in expression of e^{e^x}

(a) $e^{x^2/2}$ (b) $\log(1+2x)$

(c) $\frac{1}{\lfloor n}\left\{1+\frac{2^n}{\lfloor 2}+\frac{3^n}{\lfloor 3}+......\text{upto } \infty\right\}$ (d) $\frac{1}{\lfloor n}\left\{1-\frac{2^n}{\lfloor 2}+\frac{3^n}{\lfloor 3}-\frac{4^n}{\lfloor 4}+......\text{upto } \infty\right\}$

62. For $0 \le x < 1$, which is correct

(a) $\log(1+x) < x$ (b) $\log(1+x) \le x$

(c) $\log(1+x) > x$ (d) $\log(1+x) \le x$

63. Which one is correct for $n \in N$

(a) $|\sin nx| \ge n|\sin x|$ (b) $|\sin nx| \le n|\sin x|$

(c) $|\sin nx| > \frac{3}{2}n|\sin x|$ (d) none of these

64. The integral part of $(8+3\sqrt{7})^n$ is

(a) an even integer (b) an odd integer

(c) an integer of type $4n+1,\ n \ge 1$ (d) an integer of type $4n-1,\ n \le 1$

65. Let $P(n)$ is any statement for $n \in N$ such that $P(k)$ is true where $(k \in N) \ge 1$ and $P(n) \Rightarrow P(n+1)$ for all natural numbers, then $P(n)$ is said to be true

(a) $\forall\ n \in N$ (b) $\forall\ (n \ge k) \in N$

(c) for some $n \in N$ (d) nothing can be said

66. A particle is projected with velocity u at an angle α with the horizontal. It will be moving at right angles to this direction after a time

(a) $\frac{g}{u}\operatorname{cosec}\alpha$ (b) $\frac{u}{g}\operatorname{cosec}\alpha$ (c) $\frac{u}{g}\cos\alpha$ (d) none of these

67. A man on a lift ascending with an acceleration $f\ \text{m/sec}^2$ throws a ball vertically upwards with a velocity of $v\ \text{m/sec}$ relatively to the lift and catches it again in t seconds, then

(a) $f+g=\frac{2v}{t}$ (b) $f+g=\frac{v}{2t}$

(c) $f+g=\frac{t}{2v}$ (d) none of these

68. *ABCD* is a rectangle in which *AB* = *DC* = *a* and *AD* = *BC* = *b*. Forces each of magnitude *Q* act along *AD* and *CB* and forces each of magnitude *P* act along *AB* and *CD*. The perpendicular distance between the resultant of *P* and *Q* at *A* and that of *P* and *Q* at *C* is

(a) $\dfrac{Qb - Pa}{\sqrt{P^2 + Q^2}}$ (b) $\dfrac{Pa - Qb}{\sqrt{P^2 + Q^2}}$ (c) $\dfrac{|Qb - Pa|}{\sqrt{P^2 + Q^2}}$ (d) none of these

69. The resultant of two forces *P* and *Q* is *R*. If *Q* is doubled, *R* is doubled and if *Q* is reversed, *R* is again doubled. If the ratio $p^2 : Q^2 : R^2 = 2 : 3 : x$ then *x* is equal to

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

70. Two forces *P* and *Q* have a resultant *R* and the resolved part of *R* in the direction of *P* is of magnitude *Q*. The angle between the forces is

(a) $2\sin^{-1}\left(\dfrac{P}{2Q}\right)^{1/2}$ (b) $2\sin^{-1}\left(\dfrac{Q}{2P}\right)^{1/2}$

(c) $2\sin^{-1}\left(\dfrac{2P}{2Q}\right)$ (d) none of these

71. Three forces *P*, *Q* and *R* act along the sides *BC*, *CA* and *AB* respectively of a triangle *ABC* taken in order. If the resultant of these forces passes through the circumcentre of the triangle, then

(a) $P + Q + R = 0$ (b) $P \cos A + Q \cos B + R \cos C = 0$

(c) $P \sec A + Q \sec B + R \sec C = 0$ (d) none of these

72. Vector projection of a vector $\vec{a}$ on another vector $\vec{b}$ is

(a) $\dfrac{\vec{a} \cdot \vec{b}}{|\vec{b}|}$ (b) $(\vec{a} \cdot \vec{b})\,\hat{b}$

(c) $(\vec{a} \cdot \vec{b})\,\vec{b}$ (d) $\dfrac{(\vec{a} \cdot \vec{b})}{|\vec{b}|}\hat{b}$

[

73. If $|\vec{a}| = 2, |\vec{b}| = 3$ and $|\vec{c}| = 4$, then $[\vec{a} + \vec{b} \quad \vec{b} + \vec{c} \quad \vec{c} - \vec{a}]$ is equal to

(a) 24 (b) –24 (c) 0 (d) 48

74. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}, |\vec{a}| = 3 |\vec{b}| = 5$ and $|\vec{c}| = 7$, then the angle θ between $\vec{a}$ and $\vec{b}$ is

(a) 90° (b) 45° (c) 60° (d) 120°

75. If $\hat{a}$ is a unit vector, then $|\hat{a} \times \hat{i}|^2 + |\hat{a} \times \hat{j}|^2 + |\hat{a} \times \hat{k}|^2$ is equal to

(a) 1 (b) 2 (c) 0 (d) none of these

76. Sum of the roots of the equation $x^2 + |x| - 6 = 0$ is

(a) 0 (b) –1 (c) 5 (d) none of these.

77. If the roots of the equation $2x^2 - (a^3 + 1)x + (a^2 - 2a) = 0$ are of opposite signs, then the set of possible value of a is

(a) (0, 2) (b) [0, 2] (c) (0, 2] (d) [0, 2)

78. If the equations $ax^2+2cx+b=0$ and $ax^2+2bx+c=0$ $(b \neq c)$ have a common root, then $a+4b+4c=$

(a) 0 (b) 2 (c) –2 (d) 1

79. The equation $x^{\frac{3}{4}(\log_2 x)^2+\log_2 x-\frac{5}{4}}=\sqrt{2}$ has

(a) atleast one real solution (b) exactly three real solutions

(c) exactly one real solution (d) complex roots

80. If $x \in R$, then the maximum and minimum values of $\frac{x^2+14x+9}{x^2+2x+3}$ are

(a) 3, 1 (b) $0, -\infty$ (c) 4, –5 (d) $\infty, -\infty$

81. If $a, b, c \in R$ and the equation $ax^2+bx+c=0$, $a \neq 0$, has real roots α and β satisfying $\alpha < -1$ and $\beta > 1$, then $1+\frac{c}{a}+\left|\frac{b}{a}\right|$ is

(a) positive (b) negative (c) zero (d) none of these

82. The number of all four digital numbers that can be formed by using the digits 1, 2, 3, 4 and 4 and which are divisible by 4 is

(a) 125 (b) 120 (c) 95 (d) 30

83. The number of arrangements of the letters of the word 'BANANA' in which two *N*'s donot appear adjacently is

(a) 40 (b) 60 (c) 80 (d) 100

84. The sum $\sum_{i=0}^{m}\binom{10}{i}\binom{20}{m-i}$, $\left(\text{where } \binom{p}{q}=0 \text{ if } p<q\right)$ is maximum when *m* is

(a) 5 (b) 15 (c) 10 (d) 20

85. Number of divisors of n = 38808 (except 1 and n) is

(a) 70 (b) 68 (c) 72 (d) 74

86. The digit in the units place of the number 1! + 2! + … + 99! is

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

87. Fifteen coupons are numbered 1 to 15. Seven coupons are selected at random, one at a time with replacement. The probability that the largest number appearing on a selected coupon be not more than 9, is

(a) $\left(\frac{9}{16}\right)^6$ (b) $\left(\frac{8}{15}\right)^7$ (c) $\left(\frac{3}{5}\right)^7$ (d) none of these

88. The letters of the word "MALEN KOV' are arranged in all possible ways. The chance that there are exactly four letters between *M* and *E* is

(a) $\frac{3}{28}$ (b) $\frac{3}{14}$ (c) $\frac{1}{14}$ (d) none of these.

89. Either of the two persons throw a pair of dice once. The chance that their throws are identical is

(a) $\frac{73}{648}$ (b) $\frac{1}{216}$ (c) $\frac{575}{648}$ (d) none of these

90. Dialing a telephone number, an old person forgets last three digits. Remembering only that these digits are different, he dialed at random. The chance that the number dialed is correct is

(a) $\frac{1}{1000}$ (b) $\frac{1}{720}$ (c) $\frac{1}{120}$ (d) none of these

91. If the probability that a man aged *x* years will die within a year be *p*, then the chance that out of 5 men *A*, *B*, *C*, *D* and *E*, each aged *x* years; *A* will die during the year and be the first to die is

(a) $\frac{1}{5}p(1-p)^4$ (b) $\frac{1}{5}(1-(1-p)^5)$ (c) $5(1-(1-p)^5)$ (d) none of these

92. Five unbiased coins are tossed simultaneously. If the probability of getting atmost *n* heads is 0.5, the value of *n* is

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

93. A box contains 50 tickets numbered 1, 2, 3, …, 50 of which five are drawn at random and arranged in ascending order of magnitude $(x_1 < x_2 < x_3 < x_4 < x_5)$. The probability that $x_3 = 30$ is

(a) $\frac{^{20}C_2\,^{29}C_2}{^{50}C_5}$ (b) $\frac{^{20}C_2}{^{50}C_5}$ (c) $\frac{^{29}C_2}{^{50}C_5}$ (d) none of these

94. Let the three-digit numbers *A*28, 3*B*9, 62*C*, where *A*, *B* and *C* are integers between 0 and 9 be divisible by a fixed integer *k*. Then determinant $\begin{vmatrix} A & 3 & 6 \\ 8 & 9 & C \\ 2 & B & 2 \end{vmatrix}$ is divisible by.

(a) k (b) $2k$ (c) $3k$ (d) $4k$

95. Let α be a repeated root of the quadratic equation $f(x) = 0$ and $A(x), B(x), C(x)$ be polynomials of degree 3, 4 and 5 respectively, then show that $\begin{vmatrix} A(x) & B(x) & C(x) \\ A(\alpha) & B(\alpha) & C(\alpha) \\ A'(\alpha) & B'(\alpha) & C'(\alpha) \end{vmatrix}$ is divisible by

(a) $f(-x)$ (b) $f(x)$

(c) $f(2x)$ (d) $f'(x)$

96. If $f(x) = \begin{vmatrix} 1 & x & x+1 \\ 2x & x(x-1) & x(x+1) \\ 3x(x-1) & x(x-1)(x-2) & (x+1)x(x-1) \end{vmatrix}$ then $f(100)$ is equal to

(a) 0 (b) 1

(c) 100 (d) –100

97. If $abc \neq 0$, then $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix}$ is equal to

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

(c) $abc\left(1+\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)$ (d) none of these

98. If A and B are symmetric matrices of the same order, then

(a) AB is a symmetric matrix (b) $A - B$ is a skew-symmetric matrix

(c) $AB + BA$ is a symmetric matrix (d) $AB - BA$ is a symmetric matrix

99. If A and B are any 2×2 matrices, then det $(A + B) = 0$ implies

(a) det A + det B = 0 (b) det A = 0 or det B = 0

(c) det A = 0 and det B = 0 (d) none of these

100. If $a > 0$ and discriminant of $ax^2 + 2bx + c$ is negative, then

$$\begin{vmatrix} a & b & ax+b \\ b & c & bx+c \\ ax+b & bx+c & 0 \end{vmatrix} = 0$$

(a) $+ve$ (b) $-ve$

(c) 0 (d) $(ac-b)^2(ax^2+2bx+c)$