1. Given the sets $A = \{1,2,3\}, B = \{3,4\}$, C = {4, 5, 6}, then $A \cup (B \cap C)$ is

(a) {3} (b) {1, 2, 3, 4}
(c) {1, 2, 4, 5} (d) {1, 2, 3, 4, 5, 6}

2. If A and B are any two sets, then $A \cup (A \cap B)$ is equal to

(a) A (b) B
(c) A^c (d) B^c

3. If A and B are two given sets, then $A \cap (A \cap B)^c$ is equal to

(a) A (b) B
(c) ϕ (d) $A \cap B^c$

4. If the sets A and B are defined as

$A = \{(x, y) : y = \frac{1}{x}, 0 \neq x \in R\}$

$B = \{(x, y) : y = -x, x \in R\}$, then

(a) $A \cap B = A$ (b) $A \cap B = B$
(c) $A \cap B = \phi$ (d) None of these

5. Let $A = [x : x \in R, |x| < 1]$; $B = [x : x \in R, |x - 1| \geq 1]$ and $A \cup B = R - D$, then the set D is

(a) $[x : 1 < x \leq 2]$ (b) $[x : 1 \leq x < 2]$
(c) $[x : 1 \leq x \leq 2]$ (d) None of these

6. Let R be a reflexive relation on a set A and I be the identity relation on A. Then

(a) $R \subset I$ (b) $I \subset R$
(c) $R = I$ (d) None of these

7. Let A = {1, 2, 3, 4} and R be a relation in A given by R = {(1, 1), (2, 2), (3, 3), (4, 4), (1, 2), (2, 1), (3, 1), (1, 3)}.
Then R is

(a) Reflexive
(b) Symmetric
(c) Transitive
(d) An equivalence relation

8. An integer m is said to be related to another integer n if m is a multiple of n. Then the relation is

(a) Reflexive and symmetric
(b) Reflexive and transitive
(c) Symmetric and transitive
(d) Equivalence relation

9. If the coefficient of x^7 in $\left(ax^2 + \frac{1}{bx}\right)^{11}$ is equal to the coefficient of x^{-7} in $\left(ax - \frac{1}{bx^2}\right)^{11}$, then ab =

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

10. If the coefficient of x in the expansion of $\left(x^2 + \frac{k}{x}\right)^5$ is 270, then k =

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

11. $\frac{d}{dx}\left(\tan^{-1}\frac{\cos x}{1+\sin x}\right) =$

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

12. $\frac{d}{dx}[\cos(1-x^2)^2] =$

(a) $-2x(1-x^2)\sin(1-x^2)^2$ (b) $-4x(1-x^2)\sin(1-x^2)^2$
(c) $4x(1-x^2)\sin(1-x^2)^2$ (d) $-2(1-x^2)\sin(1-x^2)^2$

13. $\frac{d}{dx}\left(x^2 \sin\frac{1}{x}\right) =$

(a) $\cos\left(\frac{1}{x}\right) + 2x\sin\left(\frac{1}{x}\right)$ (b) $2x\sin\left(\frac{1}{x}\right) - \cos\left(\frac{1}{x}\right)$
(c) $\cos\left(\frac{1}{x}\right) - 2x\sin\left(\frac{1}{x}\right)$ (d) None of these

14. If $y = \cos(\sin x^2)$, then at $x = \sqrt{\frac{\pi}{2}}, \frac{dy}{dx} =$

(a) – 2 (b) 2
(c) $-2\sqrt{\frac{\pi}{2}}$ (d) 0

15. If $y = \sin^{-1}(x\sqrt{1-x} + \sqrt{x}\sqrt{1-x^2})$, then $\frac{dy}{dx} =$

(a) $\frac{-2x}{\sqrt{1-x^2}} + \frac{1}{2\sqrt{x-x^2}}$ (b) $\frac{-1}{\sqrt{1-x^2}} - \frac{1}{2\sqrt{x-x^2}}$
(c) $\frac{1}{\sqrt{1-x^2}} + \frac{1}{2\sqrt{x-x^2}}$ (d) None of these

16. If $x^3 + 8xy + y^3 = 64$, then $\frac{dy}{dx} =$

(a) $-\frac{3x^2+8y}{8x+3y^2}$ (b) $\frac{3x^2+8y}{8x+3y^2}$
(c) $\frac{3x+8y^2}{8x^2+3y}$ (d) None of these

17. If $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$, then $\frac{dy}{dx} =$

(a) $-\frac{ax+hy+g}{hx-by+f}$ (b) $\frac{ax+hy+g}{hx-by+f}$

(c) $\frac{ax-hy-g}{hx-by-f}$ (d) None of these

18. $\cos^{-1}\left(\cos\frac{7\pi}{6}\right) =$

(a) $\frac{7\pi}{6}$ (b) $\frac{5\pi}{6}$

(c) $\frac{\pi}{6}$ (d) None of these

19. The value of $\sin\cot^{-1}\tan\cos^{-1}x$ is equal to

(a) x (b) $\frac{\pi}{2}$

(c) 1 (d) None of these

20. $\sin^{-1}\frac{\sqrt{x}}{\sqrt{x+a}}$ is equal to

(a) $\cos^{-1}\sqrt{\frac{x}{a}}$ (b) $\text{cosec}^{-1}\sqrt{\frac{x}{a}}$

(c) $\tan^{-1}\sqrt{\frac{x}{a}}$ (d) None of these

21. If $\tan\theta = \frac{-4}{3}$, then $\sin\theta =$

(a) – 4/5 but not 4/5 (b) – 4/5 or 4/5

(c) 4/5 but not – 4/5 (d) None of these

22. If $\sin\theta = -\frac{1}{\sqrt{2}}$ and $\tan\theta = 1$, then θ lies in which quadrant

(a) First (b) Second

(c) Third (d) Fourth

23. If $\sin\theta = \frac{-4}{5}$ and θ lies in the third quadrant, then $\cos\frac{\theta}{2} =$

(a) $\frac{1}{\sqrt{5}}$ (b) $-\frac{1}{\sqrt{5}}$

(c) $\sqrt{\frac{2}{5}}$ (d) $-\sqrt{\frac{2}{5}}$

24. If $\sin(\alpha-\beta) = \frac{1}{2}$ and $\cos(\alpha+\beta) = \frac{1}{2}$, where α and β are positive acute angles, then

(a) $\alpha = 45°, \beta = 15°$ (b) $\alpha = 15°, \beta = 45°$

(c) $\alpha = 60°, \beta = 15°$ (d) None of these

25. If $\tan\theta = -\frac{1}{\sqrt{10}}$ and θ lies in the fourth quadrant, then $\cos\theta =$

(a) $1/\sqrt{11}$ (b) $-1/\sqrt{11}$

(c) $\sqrt{\frac{10}{11}}$ (d) $-\sqrt{\frac{10}{11}}$

26. If $x + y + z = 180^o$, then $\cos 2x + \cos 2y - \cos 2z$ is equal to

(a) $4\sin x.\sin y.\sin z$ (b) $1 - 4\sin x.\sin y.\cos z$

(c) $4\sin x.\sin y.\sin z - 1$ (d) $\cos A.\cos B.\cos C$

27. If $\alpha + \beta + \gamma = 2\pi$, then

(a) $\tan\frac{\alpha}{2} + \tan\frac{\beta}{2} + \tan\frac{\gamma}{2} = \tan\frac{\alpha}{2}\tan\frac{\beta}{2}\tan\frac{\gamma}{2}$

(b) $\tan\frac{\alpha}{2}\tan\frac{\beta}{2} + \tan\frac{\beta}{2}\tan\frac{\gamma}{2} + \tan\frac{\gamma}{2}\tan\frac{\alpha}{2} = 1$

(c) $\tan\frac{\alpha}{2} + \tan\frac{\beta}{2} + \tan\frac{\gamma}{2} = -\tan\frac{\alpha}{2}\tan\frac{\beta}{2}\tan\frac{\gamma}{2}$

(d) None of these

28. If $A + B + C = \pi$, then $\cos 2A + \cos 2B + \cos 2C =$

(a) $1 + 4\cos A\cos B\sin C$

(b) $-1 + 4\sin A\sin B\cos C$

(c) $-1 - 4\cos A\cos B\cos C$

(d) None of these

29. If $A + B + C = 180^o$, then $\frac{\sin 2A + \sin 2B + \sin 2C}{\cos A + \cos B + \cos C - 1} =$

(a) $8\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$ (b) $8\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$

(c) $8\sin\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$ (d) $8\cos\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$

30. *A, B, C* are the angles of a triangle, then $\sin^2 A + \sin^2 B + \sin^2 C - 2\cos A\cos B\cos C =$

(a) 1 (b) 2

(c) 3 (d) 4

31. Forces of 1, 2 *unit* act along the lines $x = 0$ and $y = 0$. The equation of the line of action of the resultant is

(a) $y - 2x = 0$ (b) $2y - x = 0$

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

32. If *N* is resolved in two components such that first is twice of other, the components are

(a) $5N, 5\sqrt{2}N$ (b) $10N, 10\sqrt{2}N$

(c) $\frac{N}{\sqrt{5}}, \frac{2N}{\sqrt{5}}$ (d) None of these

33. O is the circumcentre of $\triangle ABC$. If the forces P, Q and R acting along OA, OB, and OC are in equilibrium then $P : Q : R$ is

(a) $\sin A : \sin B : \sin C$
(b) $\cos A : \cos B : \cos C$
(c) $a\cos A : b\cos B : c\cos C$
(d) $a\sec A : b\sec B : c\sec C$

34. Three forces P, Q and R acting on a particle are in equilibrium. If the angle between P and Q is double the angle between P and R, then P is equal to

(a) $\frac{Q^2+R^2}{R}$ (b) $\frac{Q^2-R^2}{Q}$
(c) $\frac{Q^2-R^2}{R}$ (d) $\frac{Q^2+R^2}{Q}$

35. Three forces P, Q, R are acting at a point in a plane. The angle between P, Q and Q, R are 150^o and 120^o respectively, then for equilibrium; forces P, Q, R are in the ratio

(a) 1 : 2 : 3 (b) 1 : 2: $3^{1/2}$
(c) 3 : 2 : 1 (d) $(3)^{1/2}$:2 : 1

36. A couple is of moment G and the force forming the couple is P. If P is turned through a right angle, the moment of the couple thus formed is H. If instead, the force P are turned an angle α, then the moment of couple becomes

(a) $G\sin\alpha - H\cos\alpha$ (b) $H\cos\alpha + G\sin\alpha$
(c) $G\cos\alpha + H\sin\alpha$ (d) $H\sin\alpha - G\cos\alpha$

37. The resultant of the forces 4, 3, 4 and 3 *unit* acting along the lines AB, BC, CD and DA of a square $ABCD$ of side 'a' respectively is

(a) A force $5\sqrt{2}$ through the centre of the square
(b) A couple of moment 7a
(c) A null force
(d) None of these

38. For which interval, the function $\frac{x^2-3x}{x-1}$ satisfies all the conditions of Rolle's theorem

(a) [0, 3] (b) [– 3, 0]
(c) [1.5, 3] (d) For no interval

39. For the function $f(x)=e^x, a=0, b=1$, the value of c in mean value theorem will be

(a) $\log x$ (b) $\log(e-1)$
(c) 0 (d) 1

40. Rolle's theorem is not applicable to the function $f(x)=|x|$ defined on [–1, 1] because

(a) f is not continuous on [–1, 1]
(b) f is not differentiable on (–1,1)
(c) $f(-1)\neq f(1)$
(d) $f(-1)=f(1)\neq 0$

41. The direction cosines of a line equally inclined to three mutually perpendicular lines having direction cosines as $l_1,m_1,n_1; l_2,m_2,n_2$ and l_3,m_3,n_3 are

(a) $l_1+l_2+l_3, m_1+m_2+m_3, n_1+n_2+n_3$
(b) $\frac{l_1+l_2+l_3}{\sqrt{3}}, \frac{m_1+m_2+m_3}{\sqrt{3}}, \frac{n_1+n_2+n_3}{\sqrt{3}}$
(c) $\frac{l_1+l_2+l_3}{3}, \frac{m_1+m_2+m_3}{3}, \frac{n_1+n_2+n_3}{3}$
(d) None of these

42. A point (x, y, z) moves parallel to x-axis. Which of the three variable x, y, z remain fixed

(a) x (b) y and z
(c) x and y (d) z and x

43. If the direction cosines of a line are $\left(\frac{1}{c},\frac{1}{c},\frac{1}{c}\right)$, then

(a) $c>0$ (b) $c=\pm\sqrt{3}$
(c) $0<c<1$ (d) $c>2$

44. The plane XOZ divides the join of $(1,-1,5)$ and (2, 3, 4) in the ratio $\lambda : 1$, then λ is

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

45. The co-ordinates of a point P are (3, 12, 4) with respect to origin O, then the direction cosines of OP are

(a) 3, 12, 4 (b) $\frac{1}{4},\frac{1}{3},\frac{1}{2}$
(c) $\frac{3}{\sqrt{13}},\frac{1}{\sqrt{13}},\frac{2}{\sqrt{13}}$ (d) $\frac{3}{13},\frac{12}{13},\frac{4}{13}$

46. If the planes $x+2y+kz=0$ and $2x+y-2z=0$ are at right angles, then the value of k is

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

47. If z_1, z_2, z_3 be three non-zero complex number, such that $z_2\neq z_1, a=|z_1|, b=|z_2|$ and $c=|z_3|$ suppose that $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}=0$, then $arg\left(\frac{z_3}{z_2}\right)$ is equal to

(a) $arg\left(\frac{z_2-z_1}{z_3-z_1}\right)^2$ (b) $arg\left(\frac{z_2-z_1}{z_3-z_1}\right)$
(c) $arg\left(\frac{z_3-z_1}{z_2-z_1}\right)^2$ (d) $arg\left(\frac{z_3-z_1}{z_2-z_1}\right)$

48. Let z and w be the two non-zero complex numbers such that $|z|=|w|$ and $arg\, z + arg\, w = \pi$. Then z is equal to

(a) w (b) $-w$

(c) $\overline{w}$ (d) $-\overline{w}$

49. If $|z-25i| \le 15$, then $|\max .amp(z) - \min .amp(z)| =$

(a) $\cos^{-1}\left(\frac{3}{5}\right)$ (b) $\pi - 2\cos^{-1}\left(\frac{3}{5}\right)$

(c) $\frac{\pi}{2} + \cos^{-1}\left(\frac{3}{5}\right)$ (d) $\sin^{-1}\left(\frac{3}{5}\right) - \cos^{-1}\left(\frac{3}{5}\right)$

50. If z_1, z_2 and z_3, z_4 are two pairs of conjugate complex numbers, then $arg\left(\frac{z_1}{z_4}\right) + arg\left(\frac{z_2}{z_3}\right)$ equals

(a) 0 (b) $\frac{\pi}{2}$

(c) $\frac{3\pi}{2}$ (d) π

51. The differential equation of the family of parabolas with focus at the origin and the x–axis as axis is

(a) $y\left(\frac{dy}{dx}\right)^2 + 4x\frac{dy}{dx} = 4y$ (b) $-y\left(\frac{dy}{dx}\right)^2 = 2x\frac{dy}{dx} - y$

(c) $y\left(\frac{dy}{dx}\right)^2 + y = 2xy\frac{dy}{dx}$ (d) $y\left(\frac{dy}{dx}\right)^2 + 2xy\frac{dy}{dx} + y = 0$

52. The differential equation of the family of curves for which the length of the normal is equal to a constant k, is given by

(a) $y^2\frac{dy}{dx} = k^2 - y^2$ (b) $\left(y\frac{dy}{dx}\right)^2 = k^2 - y^2$

(c) $y\left(\frac{dy}{dx}\right)^2 = k^2 + y^2$ (d) $\left(y\frac{dy}{dx}\right)^2 = k^2 + y^2$

53. The solution of the differential equation $y - x\frac{dy}{dx} = a\left(y^2 + \frac{dy}{dx}\right)$ is

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

(c) $y = c(x-a)(1+ay)$ (d) None of these

54. A particle moves in a straight line with a velocity given by $\frac{dx}{dt} = x+1$ (x is the distance described). The time taken by a particle to traverse a distance of 99 metre is

(a) $\log_{10} e$ (b) $2\log_e 10$

(c) $2\log_{10} e$ (d) $\frac{1}{2}\log_{10} e$

55. Solution of differential equation $x\,dy - y\,dx = 0$ represents

(a) Rectangular hyperbola

(b) Straight line passing through origin

(c) Parabola whose vertex is at origin

(d) Circle whose centre is at origin

56. Integral curve satisfying $y' = \frac{x^2+y^2}{x^2-y^2}, y(1)=2$ has the slope at the point (1, 0) of the curve, equal to

(a) – 5/3 (b) – 1

(c) 1 (d) 5/3

57. How many numbers between 5000 and 10,000 can be formed using the digits 1, 2, 3, 4, 5, 6, 7, 8, 9 each digit appearing not more than once in each number

(a) $5 \times {}^8P_3$ (b) $5 \times {}^8C_3$

(c) $5! \times {}^8P_3$ (d) $5! \times {}^8C_3$

58. If x, y and r are positive integers, then

${}^xC_r + {}^xC_{r-1}\,{}^yC_1 + {}^xC_{r-2}\,{}^yC_2 + ... + {}^yC_r =$

(a) $\frac{x!\,y!}{r!}$ (b) $\frac{(x+y)!}{r!}$

(c) ${}^{x+y}C_r$ (d) ${}^{xy}C_r$

59. If the angle of elevation of the top of tower at a distance 500 m from its foot is 30°, then height of the tower is

(a) $\frac{1}{\sqrt{3}}$ (b) $\frac{500}{\sqrt{3}}$

(c) $\sqrt{3}$ (d) $\frac{1}{500}$

60. For a man, the angle of elevation of the highest point of the temple situated east of him is 60°. On walking 240 *metres* to north, the angle of elevation is reduced to 30°, then the height of the temple is

(a) $60\sqrt{6}m$ (b) $60m$

(c) $50\sqrt{3}m$ (d) $30\sqrt{6}m$

61. $\int \frac{dx}{1-\sin x} =$

(a) $x + \cos x + c$ (b) $1 + \sin x + c$

(c) $\sec x - \tan x + c$ (d) $\sec x + \tan x + c$

62. If $\int (\sin 2x - \cos 2x)\,dx = \frac{1}{\sqrt{2}}\sin(2x-a) + b$, then

(a) $a=\frac{\pi}{4}, b=0$

(b) $a=-\frac{\pi}{4}, b=0$

(c) $a=\frac{5\pi}{4}, b=$ any constant

(d) $a=-\frac{5\pi}{4}, b=$ any constant

63. The area in the first quadrant between $x^2+y^2=\pi^2$ and $y=\sin x$ is

(a) $\frac{(\pi^3-8)}{4}$ (b) $\frac{\pi^3}{4}$

(c) $\frac{(\pi^3-16)}{4}$ (d) $\frac{(\pi^3-8)}{2}$

64. The area bounded by the curves $y^2-x=0$ and $y-x^2=0$ is

(a) $\frac{7}{3}$ (b) $\frac{1}{3}$

(c) $\frac{5}{3}$ (d) 1

65. If $\int_{-1}^{4} f(x)dx=4$ and $\int_{2}^{4}(3-f(x))dx=7$, then the value of $\int_{2}^{-1} f(x)dx$ is

(a) 2 (b) – 3

(c) – 5 (d) None of these

66. The directrix of the parabola $x^2-4x-8y+12=0$ is

(a) $x=1$ (b) $y=0$

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

67. The equation of the parabola with focus (0, 0) and directrix $x+y=4$ is

(a) $x^2+y^2-2xy+8x+8y-16=0$

(b) $x^2+y^2-2xy+8x+8y=0$

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

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

68. The eccentricity of the curve represented by the equation $x^2+2y^2-2x+3y+2=0$ is

(a) 0 (b) 1/2

(c) $1/\sqrt{2}$ (d) $\sqrt{2}$

69. For the ellipse $25x^2+9y^2-150x-90y+225=0$ the eccentricity $e=$

(a) 2/5 (b) 3/5

(c) 4/5 (d) 1/5

70. The equation of the tangent parallel to $y-x+5=0$ drawn to $\frac{x^2}{3}-\frac{y^2}{2}=1$ is

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

(c) $x+y-1=0$ (d) $x+y+2=0$

71. Let E be the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$ and C be the circle $x^2+y^2=9$. Let P and Q be the points (1, 2) and (2, 1) respectively. Then

(a) Q lies inside C but outside E

(b) Q lies outside both C and E

(c) P lies inside both C and E

(d) P lies inside C but outside E

72. If α, β, γ are roots of equation $x^3+ax^2+bx+c=0$, then $\alpha^{-1}+\beta^{-1}+\gamma^{-1}=$

(a) a/c (b) $-b/c$

(c) b/a (d) c/a

73. If $\frac{2x}{2x^2+5x+2}>\frac{1}{x+1}$, then

(a) $-2>x>-1$ (b) $-2\geq x\geq -1$

(c) $-2<x<-1$ (d) $-2<x\leq -1$

74. If $a<0$ then the inequality $ax^2-2x+4>0$ has the solution represented by

(a) $\frac{1+\sqrt{1-4a}}{a}>x>\frac{1-\sqrt{1-4a}}{a}$

(b) $x<\frac{1-\sqrt{1-4a}}{a}$

(c) $x<2$

(d) $2>x>\frac{1+\sqrt{1-4a}}{a}$

75. The two roots of an equation $x^3-9x^2+14x+24=0$ are in the ratio 3 : 2. The roots will be

(a) 6, 4, – 1 (b) 6, 4, 1

(c) – 6, 4, 1 (d) – 6, – 4, 1

76. If $x=\sqrt{1+\sqrt{1+\sqrt{1+\text{.......to infinity}}}}$, then $x=$

(a) $\frac{1+\sqrt{5}}{2}$ (b) $\frac{1-\sqrt{5}}{2}$

(c) $\frac{1\pm\sqrt{5}}{2}$ (d) None of these

77. For the equation $|x^2|+|x|-6=0$, the roots are

(a) One and only one real number

(b) Real with sum one

(c) Real with sum zero

(d) Real with product zero

78. If $ax^2+bx+c=0$, then x =

(a) $\frac{b\pm\sqrt{b^2-4ac}}{2a}$ (b) $\frac{-b\pm\sqrt{b^2-ac}}{2a}$

(c) $\frac{2c}{-b\pm\sqrt{b^2-4ac}}$ (d) None of these

79. If the equations $2x^2+3x+5\lambda=0$ and $x^2+2x+3\lambda=0$ have a common root, then $\lambda=$

(a) 0 (b) –1

(c) 0,–1 (d) 2,–1

80. If the equation $x^2+\lambda x+\mu=0$ has equal roots and one root of the equation $x^2+\lambda x-12=0$ is 2, then (λ,μ) =

(a) (4, 4) (b) (–4,4)

(c) (4,–4) (d) (–4,–4)

81. If $1+\cos\alpha+\cos^2\alpha+.......\infty=2-\sqrt{2},$ then α, $(0<\alpha<\pi)$ is

(a) $\pi/8$ (b) $\pi/6$

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

82. The first term of an infinite geometric progression is x and its sum is 5. Then

(a) $0\le x\le 10$ (b) $0<x<10$

(c) $-10<x<0$ (d) $x>10$

83. If a,b,c are in H.P., then the value of $\left(\frac{1}{b}+\frac{1}{c}-\frac{1}{a}\right)\left(\frac{1}{c}+\frac{1}{a}-\frac{1}{b}\right)$, is

(a) $\frac{2}{bc}+\frac{1}{b^2}$ (b) $\frac{3}{c^2}+\frac{2}{ca}$

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

84. If the length of tangent drawn from the point (5, 3) to the circle $x^2+y^2+2x+ky+17=0$ be 7, then k =

(a) 4 (b) – 4

(c) – 6 (d) 13/2

85. The line $lx+my+n=0$ will be a tangent to the circle $x^2+y^2=a^2$ iff

(a) $n^2(l^2+m^2)=a^2$ (b) $a^2(l^2+m^2)=n^2$

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

86. If **a** and **b** are *P.V.* of two points *A* and *B* and *C* divides *AB* in ratio 2 : 1, then *P.V.* of *C* is

(a) $\frac{\mathbf{a}+2\mathbf{b}}{3}$ (b) $\frac{2\mathbf{a}+\mathbf{b}}{3}$

(c) $\frac{\mathbf{a}+2}{3}$ (d) $\frac{\mathbf{a}+\mathbf{b}}{2}$

87. If A,B,C are the vertices of a triangle whose position vectors are **a**, **b**, **c** and *G* is the centroid of the ΔABC, then $\overrightarrow{GA}+\overrightarrow{GB}+\overrightarrow{GC}$ is

(a) **0** (b) $\vec{A}+\vec{B}+\vec{C}$

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

88. If *O* is origin and *C* is the mid point of $A(2,-1)$ and $B(-4,3)$. Then value of $\overrightarrow{OC}$ is

(a) **i** + **j** (b) **i** – **j**

(c) – **i** + **j** (d) – **i** – **j**

89. If $ABCDEF$ is regular hexagon, then $\overrightarrow{AD}+\overrightarrow{EB}+\overrightarrow{FC}=$

(a) 0 (b) $2\overrightarrow{AB}$

(c) $3\overrightarrow{AB}$ (d) $4\overrightarrow{AB}$

90. If position vectors of a point *A* is **a** + 2**b** and **a** divides *AB* in the ratio $2:3$, then the position vector of *B* is

(a) $2\mathbf{a}-\mathbf{b}$ (b) $\mathbf{b}-2\mathbf{a}$

(c) $\mathbf{a}-3\mathbf{b}$ (d) **b**

91. If **a** and **b** are two non-zero vectors, then the component of **b** along **a** is

(a) $\frac{(\mathbf{a}.\mathbf{b})\mathbf{a}}{\mathbf{b}.\mathbf{b}}$ (b) $\frac{(\mathbf{a}.\mathbf{b})\mathbf{b}}{\mathbf{a}.\mathbf{a}}$

(c) $\frac{(\mathbf{a}.\mathbf{b})\mathbf{b}}{\mathbf{a}.\mathbf{b}}$ (d) $\frac{(\mathbf{a}.\mathbf{b})\mathbf{a}}{\mathbf{a}.\mathbf{a}}$

92. A vector of magnitude 14 lies in the *xy*-plane and makes an angle of 60^o with *x*-axis. The components of the vector in the direction of *x*-axis and *y*-axis are

(a) $7, 7\sqrt{3}$ (b) $7\sqrt{3}, 7$

(c) $14\sqrt{3}, 14/\sqrt{3}$ (d) $14/\sqrt{3}, 14\sqrt{3}$

93. If $\mathbf{a}=4\mathbf{i}+6\mathbf{j}$ and $\mathbf{b}=3\mathbf{j}+4\mathbf{k}$, then the component of **a** along **b** is

(a) $\frac{18}{10\sqrt{3}}(3\mathbf{j}+4\mathbf{k})$ (b) $\frac{18}{25}(3\mathbf{j}+4\mathbf{k})$

(c) $\frac{18}{\sqrt{3}}(3\mathbf{j}+4\mathbf{k})$ (d) $(3\mathbf{j}+4\mathbf{k})$

94. Let $\mathbf{b}=3\mathbf{j}+4\mathbf{k}$, $\mathbf{a}=\mathbf{i}+\mathbf{j}$ and let $\mathbf{b}_1$ and $\mathbf{b}_2$ be component vectors of **b** parallel and perpendicular to **a**. If $\mathbf{b}_1=\frac{3}{2}\mathbf{i}+\frac{3}{2}\mathbf{j}$, then $\mathbf{b}_2=$

(a) $\frac{3}{2}\mathbf{i}+\frac{3}{2}\mathbf{j}+4\mathbf{k}$ (b) $-\frac{3}{2}\mathbf{i}+\frac{3}{2}\mathbf{j}+4\mathbf{k}$

(c) $-\frac{3}{2}\mathbf{i}+\frac{3}{2}\mathbf{j}$ (d) None of these

95. A letter is known to have come either from LONDON or CLIFTON; on the postmark only the two consecutive letters ON are legible. The probability that it came from LONDON is

(a) $\frac{5}{17}$ (b) $\frac{12}{17}$

(c) $\frac{17}{30}$ (d) $\frac{3}{5}$

96. Let $0 < P(A) < 1$, $0 < P(B) < 1$ and $P(A \cup B) = P(A) + P(B) - P(A)P(B)$. Then

(a) $P(B/A) = P(B) - P(A)$

(b) $P(A^c \cup B^c) = P(A^c) + P(B^c)$

(c) $P(A \cup B)^c = P(A^c)P(B^c)$

(d) $P(A/B) = P(A)$

97. For a biased die the probabilities for different faces to turn up are given below

Face :	1	2	3	4	5	6
Probability :	0.1	0.32	0.21	0.15	0.05	0.17

The die is tossed and you are told that either face 1 or 2 has turned up. Then the probability that it is face 1, is

(a) $\frac{5}{21}$ (b) $\frac{5}{22}$

(c) $\frac{4}{21}$ (d) None of these

98. In a certain town, 40% of the people have brown hair, 25% have brown eyes and 15% have both brown hair and brown eyes. If a person selected at random from the town, has brown hair, the probability that he also has brown eyes, is

(a) $\frac{1}{5}$ (b) $\frac{3}{8}$

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

99. There are 3 bags which are known to contain 2 white and 3 black balls; 4 white and 1 black balls and 3 white and 7 black balls respectively. A ball is drawn at random from one of the bags and found to be a black ball. Then the probability that it was drawn from the bag containing the most black balls is

(a) $\frac{7}{15}$ (b) $\frac{5}{19}$

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

100. In an entrance test there are multiple choice questions. There are four possible answers to each question of which one is correct. The probability that a student knows the answer to a question is 90%. If he gets the correct answer to a question, then the probability that he was guessing, is

(a) $\frac{37}{40}$ (b) $\frac{1}{37}$

(c) $\frac{36}{37}$ (d) $\frac{1}{9}$

101. The interval for which $\sin^{-1}\sqrt{x} + \cos^{-1}\sqrt{x} = \frac{\pi}{2}$ holds

(a) $[0, \infty)$ (b) $[0, 3]$

(c) [0, 1] (d) [0, 2]

102. Function $\sin^{-1}\sqrt{x}$ is defined in the interval

(a) (–1, 1) (b) [0, 1]

(c) [–1, 0] (d) (–1, 2)

103. $\lim_{x \to 0} \frac{e^{x^2} - \cos x}{x^2} =$

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

(c) 1 (d) None of these

104. $\lim_{x \to 0} \frac{\log(a+x) - \log a}{x} + k \lim_{x \to e} \frac{\log x - 1}{x - e} = 1$, then

(a) $k = e\left(1 - \frac{1}{a}\right)$

(b) $k = e(1+a)$

(c) $k = e(2-a)$

(d) The equality is not possible

105. Which of the following is not true

(a) Every differentiable function is continuous

(b) If derivative of a function is zero at all points, then the function is constant

(c) If a function has maximum or minima at a point, then the function is differentiable at that point and its derivative is zero

(d) If a function is constant, then its derivative is zero at all points

106. For the function $f(x) = \begin{cases} \frac{e^{1/x} - 1}{e^{1/x} + 1}, & x \neq 0 \\ 0, & x = 0 \end{cases}$, which of the following is correct

(a) $\lim_{x \to 0} f(x)$ does not exist

(b) $f(x)$ is continuous at $x = 0$

(c) $\lim_{x \to 0} f(x) = 1$

(d) $\lim_{x \to 0} f(x)$ exists but $f(x)$ is not continuous at $x = 0$

107. The function 'f' is defined by $f(x) = 2x - 1$, if $x > 2$, $f(x) = k$ if $x = 2$ and $x^2 - 1$, if $x < 2$ is continuous, then the value of k is equal to

(a) 2 (b) 3

(c) 4 (d) –3

108. A ray of light coming from the point (1, 2) is reflected at a point A on the x–axis and then passes through the point (5, 3). The coordinates of the point A are

(a) $(13/5, 0)$ (b) $(5/13, 0)$

(c) (– 7, 0) (d) None of these

109. If the co-ordinates of the middle point of the portion of a line intercepted between coordinate axes (3,2), then the equation of the line will be

(a) $2x + 3y = 12$ (b) $3x + 2y = 12$

(c) $4x - 3y = 6$ (d) $5x - 2y = 10$

110. A line through $A(-5, -4)$ meets the lines $x + 3y + 2 = 0$, $2x + y + 4 = 0$ and $x - y - 5 = 0$ at B, C and D respectively. If $\left(\frac{15}{AB}\right)^2 + \left(\frac{10}{AC}\right)^2 = \left(\frac{6}{AD}\right)^2$, then the equation of the line is

(a) $2x + 3y + 22 = 0$ (b) $5x - 4y + 7 = 0$

(c) $3x - 2y + 3 = 0$ (d) None of these

111. If $D_p = \begin{vmatrix} p & 15 & 8 \\ p^2 & 35 & 9 \\ p^3 & 25 & 10 \end{vmatrix}$, then $D_1 + D_2 + D_3 + D_4 + D_5 =$

(a) 0 (b) 25

(c) 625 (d) None of these

112. The value of $\begin{vmatrix} a & a+b & a+2b \\ a+2b & a & a+b \\ a+b & a+2b & a \end{vmatrix}$ is equal to

(a) $9a^2(a+b)$ (b) $9b^2(a+b)$

(c) $a^2(a+b)$ (d) $b^2(a+b)$

113. If a, b, c are different and $\begin{vmatrix} a & a^2 & a^3-1 \\ b & b^2 & b^3-1 \\ c & c^2 & c^3-1 \end{vmatrix} = 0$, then

(a) $a + b + c = 0$ (b) $abc = 1$

(c) $a + b + c = 1$ (c) $ab + bc + ca = 0$

114. The identity element in the group $M = \left\{ \begin{pmatrix} x & x \\ x & x \end{pmatrix} \middle| x \in R; x \neq 0 \right\}$ with respect to matrix multiplication is

(a) $\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$ (b) $\frac{1}{2}\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$

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

115. If $A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then which one of the following holds for all $n \geq 1$, (by the principal of mathematical induction)

(a) $A^n = nA + (n-1)I$ (b) $A^n = 2^{n-1}A + (n-1)I$

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

116. The new coordinates of a point (4, 5), when the origin is shifted to the point (1,–2) are

(a) (5, 3) (b) (3, 5)

(c) (3, 7) (d) None of these

117. Without changing the direction of coordinate axes, origin is transferred to (h, k), so that the linear (one degree) terms in the equation $x^2 + y^2 - 4x + 6y - 7 = 0$ are eliminated. Then the point (h, k) is

(a) (3, 2) (b) (– 3, 2)

(c) (2, – 3) (d) None of these

118. The equation of the locus of a point whose distance from (a, 0) is equal to its distance from y-axis, is

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

(c) $y^2 + 2ax + a^2 = 0$ (d) $y^2 + 2ax = a^2$

119. Two points A and B have coordinates (1, 0) and (–1, 0) respectively and Q is a point which satisfies the relation $AQ - BQ = \pm 1$. The locus of Q is

(a) $12x^2 + 4y^2 = 3$ (b) $12x^2 - 4y^2 = 3$

(c) $12x^2 - 4y^2 + 3 = 0$ (d) $12x^2 + 4y^2 + 3 = 0$

120. The locus of a point P which moves in such a way that the segment OP, where O is the origin, has slope $\sqrt{3}$ is

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

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

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