1. The centre of the conic represented by the equation $2x^2-72xy+23y^2-4x-28y-48=0$ is

(a) $\left(\frac{11}{15},\frac{2}{25}\right)$ (b) $\left(\frac{2}{25},\frac{11}{25}\right)$

(c) $\left(\frac{11}{15},-\frac{2}{25}\right)$ (d) $\left(-\frac{11}{25},-\frac{2}{25}\right)$

2. The centre of $14x^2-4xy+11y^2-44x-58y+71=0$

(a) (2, 3) (b) (2, – 3)

(c) (– 2, 3) (d) (– 2, – 3)

3. The equation of the conic with focus at (1, –1), directrix along $x-y+1=0$ and with eccentricity $\sqrt{2}$ is

(a) $x^2-y^2=1$ (b) $xy=1$

(c) $2xy-4x+4y+1=0$ (d) $2xy+4x-4y-1=0$

4. If a point $(x,y)\equiv(\tan\theta+\sin\theta,\tan\theta-\sin\theta)$, then locus of (*x*, *y*) is

(a) $(x^2y)^{2/3}+(xy^2)^{2/3}=1$ (b) $x^2-y^2=4xy$

(c) $(x^2-y^2)^2=16xy$ (d) $x^2-y^2=6xy$

5. Equation $\sqrt{(x-2)^2+y^2}+\sqrt{(x+2)^2+y^2}=4$ represents

(a) Parabola (b) Ellipse

(c) Circle (d) Pair of straight lines

6. Angle of intersection of the curves $r=\sin\theta+\cos\theta$ and $r=2\sin\theta$ is equal to

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

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

7. If $a<b<c<d$, then the roots of the equation $(x-a)(x-c)+2(x-b)(x-d)=0$ are

(a) Real and distinct (b) Real and equal

(c) Imaginary (d) None of these

8. If the roots of the equation $qx^2+px+q=0$ where *p, q* are real, be complex, then the roots of the equation $x^2-4qx+p^2=0$ are

(a) Real and unequal (b) Real and equal

(c) Imaginary (d) None of these

9. The values of 'a' for which $(a^2-1)x^2+2(a-1)x+2$ is positive for any x are

(a) $a\geq 1$ (b) $a\leq 1$

(c) $a>-3$ (d) $a<-3$ or $a>1$

10. If the roots of equation $\frac{x^2-bx}{ax-c}=\frac{m-1}{m+1}$ are equal but opposite in sign, then the value of m will be

(a) $\frac{a-b}{a+b}$ (b) $\frac{b-a}{a+b}$

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

11. The coefficient of x in the equation $x^2+px+q=0$ was taken as 17 in place of 13, its roots were found to be –2 and –15, The roots of the original equation are

(a) 3, 10 (b) – 3, – 10

(c) – 5, – 18 (d) None of these

12. If one root of the equation $ax^2+bx+c=0$ be n times the other root, then

(a) $na^2=bc(n+1)^2$ (b) $nb^2=ac(n+1)^2$

(c) $nc^2=ab(n+1)^2$ (d) None of these

13. If one root of the quadratic equation $ax^2+bx+c=0$ is equal to the n^{th} power of the other root, then the value of $(ac^n)^{\frac{1}{n+1}}+(a^nc)^{\frac{1}{n+1}}=$

(a) b (b) $-b$

(c) $b^{\frac{1}{n+1}}$ (d) $-b^{\frac{1}{n+1}}$

14. If $\sin\alpha,\cos\alpha$ are the roots of the equation $ax^2+bx+c=0$, then

(a) $a^2-b^2+2ac=0$ (b) $(a-c)^2=b^2+c^2$

(c) $a^2+b^2-2ac=0$ (d) $a^2+b^2+2ac=0$

15. If both the roots of the quadratic equation

$$x^2-2kx+k^2+k-5=0$$

are less than 5, then k lies in the interval

(a) $(-\infty,4)$ (b) [4, 5]

(c) (5, 6] (d) (6, ∞)

16. If n geometric means between a and b be $G_1,G_2,.....\,G_n$ and a geometric mean be G, then the true relation is

(a) $G_1.G_2........G_n=G$ (b) $G_1.G_2........G_n=G^{1/n}$

(c) $G_1.G_2........G_n=G^n$ (d) $G_1.G_2........G_n=G^{2/n}$

17. α,β are the roots of the equation $x^2-3x+a=0$ and γ,δ are the roots of the equation $x^2-12x+b=0$. If $\alpha,\beta,\gamma,\delta$ form an increasing G.P., then $(a,b)=$

(a) (3, 12) (b) (12, 3)

(c) (2, 32) (d) (4, 16)

18. $2.\dot{3}\dot{5}\dot{7} =$

(a) $\frac{2355}{1001}$ (b) $\frac{2370}{997}$

(c) $\frac{2355}{999}$ (d) None of these

19. If $\tan x = \frac{2b}{a-c} (a \neq c)$,

$y = a\cos^2 x + 2b \sin x \cos x + c \sin^2 x$

and $z = a\sin^2 x - 2b\sin x \cos x + c\cos^2 x$, then

(a) $y = z$ (b) $y + z = a + c$

(c) $y - z = a + c$ (d) $y - z = (a-c)^2 + 4b^2$

20. If $\text{cosec}\,\theta = \frac{p+q}{p-q}$, then $\cot\left(\frac{\pi}{4} + \frac{\theta}{2}\right) =$

(a) $\sqrt{\frac{p}{q}}$ (b) $\sqrt{\frac{q}{p}}$

(c) $\sqrt{pq}$ (d) pq

21. If $a\sin^2 x + b\cos^2 x = c$, $b\sin^2 y + a\cos^2 y = d$ and $a\tan x = b\tan y$, then $\frac{a^2}{b^2}$ is equal to

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

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

22. $\left(\frac{\cos A + \cos B}{\sin A - \sin B}\right)^n + \left(\frac{\sin A + \sin B}{\cos A - \cos B}\right)^n$ (n even or odd) =

(a) $2\tan^n \frac{A-B}{2}$ (b) $2\cot^n \frac{A-B}{2}$

(c) 0 (d) None of these

23. If $\sin\alpha = 1/\sqrt{5}$ and $\sin\beta = 3/5$, then $\beta - \alpha$ lies in the interval

(a) $[0, \pi/4]$ (b) $[\pi/2, 3\pi/4]$

(c) $[3\pi/4, \pi]$ (d) $[\pi, 5\pi/4]$

24. If $2\sec 2\alpha = \tan\beta + \cot\beta$, then one of the values of $\alpha + \beta$ is

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

(c) π (d) 2π

25. If $\frac{x}{\cos\theta} = \frac{y}{\cos\left(\theta - \frac{2\pi}{3}\right)} = \frac{z}{\cos\left(\theta + \frac{2\pi}{3}\right)}$, then $x + y + z =$

(a) 1 (b) 0

(c) -1 (d) None of these

26. The principal value of $\sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)$ is

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

(c) $\frac{4\pi}{3}$ (d) $\frac{5\pi}{3}$

27. $\cot\left[\cos^{-1}\left(\frac{7}{25}\right)\right] =$

(a) $\frac{25}{24}$ (b) $\frac{25}{7}$

(c) $\frac{24}{25}$ (d) None of these

28. If $\frac{\pi}{2} \le x \le \frac{3\pi}{2}$, then $\sin^{-1}(\sin x)$ is equal to

(a) x (b) $-x$

(c) $\pi + x$ (d) $\pi - x$

29. The angle of elevation of the top of a tower from the top of a house is 60° and the angle of depression of its base is 30°. If the horizontal distance between the house and the tower be 12 *m*, then the height of the tower is

(a) $48\sqrt{3}\ m$ (b) $16\sqrt{3}\ m$

(c) $24\sqrt{3}\ m$ (d) $16/\sqrt{3}\ m$

30. A man whose eye level is 1.5 *metres* above the ground observes the angle of elevation of a tower to be 60°. If the distance of the man from the tower be 10 meters, the height of the tower is

(a) $(1.5 + 10\sqrt{3})m$ (b) $10\sqrt{3}m$

(c) $\left(1.5 + \frac{10}{\sqrt{3}}\right)m$ (d) None of these

31. The general solution of the trigonometric equation $\tan\theta = \cot\alpha$ is

(a) $\theta = n\pi + \frac{\pi}{2} - \alpha$ (b) $\theta = n\pi - \frac{\pi}{2} + \alpha$

(c) $\theta = n\pi + \frac{\pi}{2} + \alpha$ (d) $\theta = n\pi - \frac{\pi}{2} - \alpha$

32. The solution of the equation $\sec\theta - \text{cosec}\,\theta = \frac{4}{3}$ is

(a) $\frac{1}{2}[n\pi + (-1)^n \sin^{-1}(3/4)]$ (b) $n\pi + (-1)^n \sin^{-1}(3/4)$

(c) $\frac{n\pi}{2} + (-1)^n \sin^{-1}(3/4)$ (d) None of these

33. If $\cos p\theta = \cos q\theta, p \neq q$, then

(a) $\theta = 2n\pi$ (b) $\theta = \frac{2n\pi}{p \pm q}$

(c) $\theta = \frac{n\pi}{p+q}$ (d) None of these

34. If $y = \tan^{-1}\dfrac{4x}{1+5x^2} + \tan^{-1}\dfrac{2+3x}{3-2x}$, then $\dfrac{dy}{dx} =$

(a) $\dfrac{1}{1+25x^2} + \dfrac{2}{1+x^2}$ (b) $\dfrac{5}{1+25x^2} + \dfrac{2}{1+x^2}$

(c) $\dfrac{5}{1+25x^2}$ (d) $\dfrac{1}{1+25x^2}$

35. $\dfrac{d}{dx}\log_7(\log_7 x) =$

(a) $\dfrac{1}{x\log_e x}$ (b) $\dfrac{\log_e 7}{x\log_e x}$

(c) $\dfrac{\log_7 e}{x\log_e x}$ (d) $\dfrac{\log_7 e}{x\log_7 x}$

36. If $f(x) = \sqrt{1+\cos^2(x^2)}$, then $f'\left(\dfrac{\sqrt{\pi}}{2}\right)$ is

(a) $\sqrt{\pi}/6$ (b) $-\sqrt{(\pi/6)}$

(c) $1/\sqrt{6}$ (d) $\pi/\sqrt{6}$

37. *ABCD* is a rectangle such that $AB = CD = a$ and $BC = DA = b$. Forces *P*, *P* act along *AD* and *CB*, and forces *Q*, *Q* act along *AB* and *CD*. The perpendicular distance between the resultant of forces *P*, *Q* at *A* and the resultant of forces *P*, *Q* at *C* is

(a) $\dfrac{Pa+Qb}{\sqrt{P^2+Q^2}}$ (b) $\dfrac{Pa-Qb}{\sqrt{P^2+Q^2}}$

(c) $\dfrac{Pb+Qa}{\sqrt{P^2+Q^2}}$ (d) $\dfrac{Pb-Qa}{\sqrt{P^2+Q^2}}$

38. A horizontal rod of length 5*m* and weight 4 *N* is suspended at the ends by two strings. The weights of 8*N*, 12*N*, 16*N* and 20*N* are placed on the rod at distance 1*m*, 2*m*, 3*m* and 4 *m* from one end of the rod. The tension in the strings are

(a) $26N, 34N$ (b) $20N, 30N$

(c) $10N, 40N$ (d) None of these

39. Two equal heavy rods of weight *W* and length 2*a* are freely hinged together and placed symmetrically over a smooth fixed sphere of radius *r*. The inclination θ of each rod to the horizontal is given by

(a) $r\tan\theta\sec^2\theta = a$ (b) $r(\tan^3\theta + \tan\theta) = a$

(c) $r\sin\theta = a\cos^3\theta$ (d) None of these

40. A uniform rod *AB* movable about a hinge at *A* rests with one end in contact with a smooth wall. If α be the inclination of the rod to the horizontal, then reaction at the hinge is

(a) $\dfrac{W}{2}\sqrt{3+\operatorname{cosec}^2\alpha}$ (b) $\dfrac{W}{2}\sqrt{3+\sin^2\alpha}$

(c) $W\sqrt{3+\operatorname{cosec}^2\alpha}$ (d) None of these

41. Forces of magnitudes 3, *P*, 5, 10 and *Q Newton* are respectively acting along the sides *AB*, *BC*, *CD*, *AD* and the diagonal *CA* of a rectangle *ABCD*, where *AB* = 4 *m* and *BC* = 3*m*. If the resultant is a single force along the other diagonal *BD* then *P*,*Q* and the resultant are

(a) $4, 10\dfrac{5}{12}, 12\dfrac{11}{12}$ (b) 5, 6, 7

(c) $3\dfrac{1}{2}, 8, 9\dfrac{1}{2}$ (d) None of these

42. The foot of a uniform ladder is on a rough horizontal ground and the top rests against a smooth vertical wall. The weight of the ladder is 400 *unit*. A man weighing 800 *unit* stands on the ladder at one quarter of its length from the bottom. If the inclination of the ladder to the horizontal is 30^o, the reaction at the wall is

(a) 0 (b) $1200\sqrt{3}$

(c) $800\sqrt{3}$ (d) $400\sqrt{3}$

43. A ladder, 10 *metre* long, rests with one end against a smooth vertical wall and the other end on the ground which is rough; the coefficient of friction being $\dfrac{1}{2}$. The foot of the ladder being 2 *metre* from the wall. A man whose weight is 4 times that of the ladder can ascend before it begins to slip a distance (in *metre*), is

(a) $\dfrac{3}{4}(10\sqrt{6}-1)$ (b) $\dfrac{5}{4}(10\sqrt{6}-1)$

(c) $\dfrac{2}{3}(5\sqrt{2}-1)$ (d) None of these

44. The line *L* passes through the points of intersection of the circles $x^2+y^2=25$ and $x^2+y^2-8x+7=0$. The length of perpendicular from centre of second circle onto the line *L*, is

(a) 4 (b) 3

(c) 1 (d) 0

45. If a circle passes through the point (*a*, *b*)and cuts the circle $x^2+y^2=4$ orthogonally, then locus of its centre is

(a) $2ax-2by-(a^2+b^2+4)=0$

(b) $2ax+2by-(a^2+b^2+4)=0$

(c) $2ax-2by+(a^2+b^2+4)=0$

(d) $2ax+2by+(a^2+b^2+4)=0$

46. If $f:[0,\infty)\to[0,\infty)$ and $f(x)=\frac{x}{1+x}$, then f is

(a) One-one and onto (b) One-one but not onto
(c) Onto but not one-one (d) Neither one-one nor onto

47. If $f:R\to S$ defined by $f(x)=\sin x-\sqrt{3}\cos x+1$ is onto, then the interval of S is

(a) $[-1, 3]$ (b) $[1, 1]$
(c) $[0, 1]$ (d) $[0, -1]$

48. $\lim_{x\to 0}\frac{\tan x-\sin x}{x^3}=$

(a) $\frac{1}{2}$ (b) $-\frac{1}{2}$
(c) $\frac{2}{3}$ (d) None of these

49. $\lim_{x\to 0}\frac{1-\cos x}{x}=$

(a) 0 (b) $\frac{1}{2}$
(c) $\frac{1}{3}$ (d) None of these

50. If the function $f(x)=\begin{cases}1+\sin\frac{\pi x}{2}, \text{for} -\infty<x\le 1\\ ax+b, \text{for } 1<x<3\\ 6\tan\frac{x\pi}{12}, \text{for } 3\le x<6\end{cases}$ is continuous in the interval $(-\infty, 6)$, then the values of a and b are respectively

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

51. If $f(x)=\begin{cases}x+2, -1<x<3\\ 5 \quad , \quad x=3\\ 8-x, \quad x>3\end{cases}$, then at $x=3$, $f'(x)=$

(a) 1 (b) – 1
(c) 0 (d) Does not exist

52. If $f(x)=\begin{cases}x, & 0\le x\le 1\\ 2x-1, & 1<x\end{cases}$, then

(a) f is discontinuous at $x=1$
(b) f is differentiable at $x=1$
(c) f is continuous but not differentiable at $x=1$
(d) None of these

53. For positive integers n_1, n_2 the value of the expression $(1+i)^{n_1}+(1+i^3)^{n_1}+(1+i^5)^{n_2}+(1+i^7)^{n_2}$ where $i=\sqrt{-1}$ is a real number if and only if

(a) $n_1=n_2+1$ (b) $n_1=n_2-1$
(c) $n_1=n_2$ (d) $n_1>0, n_2>0$

54. Given that the equation $z^2+(p+iq)z+r+is=0$, where p,q,r,s are real and non-zero has a real root, then

(a) $pqr=r^2+p^2s$ (b) $prs=q^2+r^2p$
(c) $qrs=p^2+s^2q$ (d) $pqs=s^2+q^2r$

55. If $x=-5+2\sqrt{-4}$, then the value of the expression $x^4+9x^3+35x^2-x+4$ is

(a) 160 (b) –160
(c) 60 (d) –60

56. If $\sqrt{3}+i=(a+ib)(c+id)$, then $\tan^{-1}\left(\frac{b}{a}\right)+\tan^{-1}\left(\frac{d}{c}\right)$ has the value

(a) $\frac{\pi}{3}+2n\pi, n\in I$ (b) $n\pi+\frac{\pi}{6}, n\in I$
(c) $n\pi-\frac{\pi}{3}, n\in I$ (d) $2n\pi-\frac{\pi}{3}, n\in I$

57. If the coefficient of $(2r+4)^{th}$ and $(r-2)^{th}$ terms in the expansion of $(1+x)^{18}$ are equal, then $r=$

(a) 12 (b) 10
(c) 8 (d) 6

58. The middle term in the expansion of $(1+x)^{2n}$ is

(a) $\frac{1.3.5....(5n-1)}{n!}x^n$ (b) $\frac{2.4.6....2n}{n!}x^{2n+1}$
(c) $\frac{1.3.5....(2n-1)}{n!}x^n$ (d) $\frac{1.3.5....(2n-1)}{n!}2^n x^n$

59. The number of words which can be made out of the letters of the word MOBILE when consonants always occupy odd places is

(a) 20 (b) 36
(c) 30 (d) 720

60. How many numbers greater than 24000 can be formed by using digits 1, 2, 3, 4, 5 when no digit is repeated

(a) 36 (b) 60
(c) 84 (d) 120

61. $\begin{vmatrix}a^2 & b^2 & c^2\\ (a+1)^2 & (b+1)^2 & (c+1)^2\\ (a-1)^2 & (b-1)^2 & (c-1)^2\end{vmatrix}=$

(a) $4\begin{vmatrix} a^2 & b^2 & c^2 \\ a & b & c \\ 1 & 1 & 1 \end{vmatrix}$ (b) $3\begin{vmatrix} a^2 & b^2 & c^2 \\ a & b & c \\ 1 & 1 & 1 \end{vmatrix}$

(c) $2\begin{vmatrix} a^2 & b^2 & c^2 \\ a & b & c \\ 1 & 1 & 1 \end{vmatrix}$ (d) None of these

62. $\begin{vmatrix} 11 & 12 & 13 \\ 12 & 13 & 14 \\ 13 & 14 & 15 \end{vmatrix} =$

(a) 1 (b) 0
(c) –1 (d) 67

63. $\begin{vmatrix} x & 4 & y+z \\ y & 4 & z+x \\ z & 4 & x+y \end{vmatrix} =$

(a) 4 (b) $x+y+z$
(c) xyz (d) 0

64. If $U = [2 -3\ 4], X = [0\ 2\ 3]$, $V = \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix}$ and $Y = \begin{bmatrix} 2 \\ 2 \\ 4 \end{bmatrix}$,

then $UV + XY$ =
(a) 20 (b) [– 20]
(c) – 20 (d) [20]

65. If $A = \begin{bmatrix} 0 & i \\ -i & 0 \end{bmatrix}$, then the value of A^{40} is

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

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

66. If (1, 3), (2, 5) and (3, 3) are three elements of $A \times B$ and the total number of elements in $A \times B$ is 6, then the remaining elements of $A \times B$ are
(a) (1, 5); (2, 3); (3, 5) (b) (5, 1); (3, 2); (5, 3)
(c) (1, 5); (2, 3); (5, 3) (d) None of these

67. A = {1, 2, 3} and B = {3, 8}, then $(A \cup B) \times (A \cap B)$ is
(a) {(3, 1), (3, 2), (3, 3), (3, 8)}
(b) {(1, 3), (2, 3), (3, 3), (8, 3)}
(c) {(1, 2), (2, 2), (3, 3), (8, 8)}
(d) {(8, 3), (8, 2), (8, 1), (8, 8)}

68. If A = {2, 3, 5}, B = {2, 5, 6}, then $(A - B) \times (A \cap B)$ is
(a) {(3, 2), (3, 3), (3, 5)} (b) {(3, 2), (3, 5), (3, 6)}
(c) {(3, 2), (3, 5)} (d) None of these

69. In a class of 30 pupils, 12 take needle work, 16 take physics and 18 take history. If all the 30 students take at least one subject and no one takes all three then the number of pupils taking 2 subjects is
(a) 16 (b) 6
(c) 8 (d) 20

70. If $n(A) = 4$, $n(B) = 3$, $n(A \times B \times C) = 24$, then $n(C) =$
(a) 288 (b) 1
(c) 12 (d) 17
(e) 2

71. A relation R is defined from {2, 3, 4, 5} to {3, 6, 7, 10} by $xRy \Leftrightarrow x$ is relatively prime to y. Then domain of R is
(a) {2, 3, 5} (b) {3, 5}
(c) {2, 3, 4} (d) {2, 3, 4, 5}

72. Let R be a relation on N defined by $x + 2y = 8$. The domain of R is
(a) {2, 4, 8} (b) {2, 4, 6, 8}
(c) {2, 4, 6} (d) {1, 2, 3, 4}

73. If $R = \{(x, y) \mid x, y \in Z, x^2 + y^2 \le 4\}$ is a relation in Z, then domain of R is
(a) {0, 1, 2} (b) {0, – 1, – 2}
(c) {– 2, – 1, 0, 1, 2} (d) None of these

74. If $y = x^2 + x^{\log x}$, then $\frac{dy}{dx} =$

(a) $\frac{x^2 + \log x . x^{\log x}}{x}$ (b) $x^2 + \log x . x^{\log x}$

(c) $\frac{2(x^2 + \log x . x^{\log x})}{x}$ (d) None of these

75. If $y = x^2 + \cfrac{1}{x^2 + \cfrac{1}{x^2 + \cfrac{1}{x^2 + ...\infty}}}$, then $\frac{dy}{dx} =$

(a) $\frac{2xy}{2y - x^2}$ (b) $\frac{xy}{y + x^2}$

(c) $\frac{xy}{y - x^2}$ (d) $\frac{2xy}{2 + \frac{x^2}{y}}$

76. If $f(x) = x + \frac{1}{x}$, $x > 0$, then its greatest value is
(a) – 2 (b) 0
(c) 3 (d) None of these

77. The perimeter of a sector is p. The area of the sector is maximum when its radius is

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

(c) $\frac{p}{2}$ (d) $\frac{p}{4}$

78. If $y = a\log x + bx^2 + x$ has its extremum value at $x = 1$ and $x = 2$, then $(a,b) =$

(a) $\left(1, \frac{1}{2}\right)$ (b) $\left(\frac{1}{2}, 2\right)$

(c) $\left(2, \frac{-1}{2}\right)$ (d) $\left(\frac{-2}{3}, \frac{-1}{6}\right)$

79. In $(-4, 4)$ the function $f(x) = \int_{-10}^{x} (t^4 - 4)e^{-4t}dt$ has

(a) No extrema (b) One extremum

(c) Two extrema (d) Four extrema

80. On [1, e] the greatest value of $x^2 \log x$

(a) e^2 (b) $\frac{1}{e}\log\frac{1}{\sqrt{e}}$

(c) $e^2 \log\sqrt{e}$ (d) None of these

81. The following points A $(2a, 4a)$, $B(2a, 6a)$ and C $(2a + \sqrt{3}a, 5a)$, $(a > 0)$ are the vertices of

(a) An acute angled triangle

(b) A right angled triangle

(c) An isosceles triangle

(d) None of these

82. If the coordinates of the vertices of a triangle be $(1,a)$, $(2,b)$ and $(c^2,3)$, then the centroid of the triangle

(a) Lies at the origin (b) Cannot lie on x-axis

(c) Cannot lie on y-axis (d) None of these

83. If the vertices of a triangle be (0,0), (6,0) and (6,8), then its incentre will be

(a) (2,1) (b) (1,2)

(c) (4,2) (d) (2,4)

84. If the middle points of the sides of a triangle be (–2, 3), (4, –3) and (4, 5), then the centroid of the triangle is

(a) (5/3, 2) (b) (5/6, 1)

(c) (2, 5/3) (d) (1, 5/6)

85. If the vertices P, Q, R of a triangle PQR are rational points, which of the following points of the triangle PQR is (are) always rational point(s)

(a) Centroid (b) Incentre

(c) Circumcentre (d) Orthocentre

(A rational point is a point both of whose coordinates are rational numbers)

86. The medians AD and BE of a triangle with vertices $A(0, b)$, $B(0, 0)$ and $C(a, 0)$ are perpendicular to each other, if

(a) $a = \sqrt{2}\,b$ (b) $a = -\sqrt{2}\,b$

(c) Both (a) and (b) (d) None of these

87. Let PS be the median of the triangle with vertices $P(2, 2)$, $Q(6, -1)$ and $R(7, 3)$. The equation of the line passing through (1, – 1) and parallel to PS is

(a) $2x - 9y - 7 = 0$ (b) $2x - 9y - 11 = 0$

(c) $2x + 9y - 11 = 0$ (d) $2x + 9y + 7 = 0$

88. The equation of straight line passing through $(-a, 0)$ and making the triangle with axes of area 'T' is

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

(c) $2Tx - a^2y - 2aT = 0$ (d) None of these

89. $\int \frac{x^5}{\sqrt{1+x^3}}dx =$

(a) $\frac{2}{9}(1+x^3)^{3/2} + c$

(b) $\frac{2}{9}(1+x^3)^{3/2} + \frac{2}{3}(1+x^3)^{1/2} + c$

(c) $\frac{2}{9}(1+x^3)^{3/2} - \frac{2}{3}(1+x^3)^{1/2} + c$

(d) None of these

90. $\int \frac{dx}{\sin x - \cos x + \sqrt{2}}$ equals

(a) $-\frac{1}{\sqrt{2}}\tan\left(\frac{x}{2} + \frac{\pi}{8}\right) + c$ (b) $\frac{1}{\sqrt{2}}\tan\left(\frac{x}{2} + \frac{\pi}{8}\right) + c$

(c) $\frac{1}{\sqrt{2}}\cot\left(\frac{x}{2} + \frac{\pi}{8}\right) + c$ (d) $-\frac{1}{\sqrt{2}}\cot\left(\frac{x}{2} + \frac{\pi}{8}\right) + c$

91. If integrating factor of $x(1-x^2)dy + (2x^2y - y - ax^3)dx = 0$ is $e^{\int Pdx}$, then P is equal to

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

(c) $\frac{2x^2 - 1}{ax^3}$ (d) $\frac{(2x^2 - 1)}{x(1-x^2)}$

92. A solution of the differential equation $\left(\frac{dy}{dx}\right)^2 - x\frac{dy}{dx} + y = 0$ is

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

(c) $y = 2x - 4$ (d) $y = 2x^2 - 4$

93. The slope of the tangent at (x, y) to a curve passing through $\left(1, \frac{\pi}{4}\right)$ is given by $\frac{y}{x} - \cos^2\left(\frac{y}{x}\right)$, then the equation of the curve is

(a) $y = \tan^{-1}\left[\log\left(\frac{e}{x}\right)\right]$ (b) $y = x\tan^{-1}\left[\log\left(\frac{x}{e}\right)\right]$

(c) $y = x\tan^{-1}\left[\log\left(\frac{e}{x}\right)\right]$ (d) None of these

94. The equation of family of curves for which the length of the normal is equal to the radius vector is

(a) $y^2 \pm x^2 = k$ (b) $y \pm x = k$

(c) $y^2 = kx$ (d) None of these

95. A continuously differentiable function $\phi(x)$ in $(0, \pi)$ satisfying $y' = 1 + y^2$, $y(0) = 0 = y(\pi)$ is

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

(c) $(x - \pi)\ (1 - e^x)$ (d) Not possible

96. The solution of the differential equation $\sqrt{a + x}\frac{dy}{dx} + xy = 0$ is

(a) $y = Ae^{2/3(2a-x)\sqrt{x+a}}$ (b) $y = Ae^{-2/3(a-x)\sqrt{x+a}}$

(c) $y = Ae^{2/3(2a+x)\sqrt{x+a}}$ (d) $y = Ae^{-2/3(2a-x)\sqrt{x+a}}$

(Where A is an arbitrary constant.)

97. If **a**, **b**, **c** are three non-coplanar vectors, then the vector equation $\mathbf{r} = (1 - \mathbf{p} - \mathbf{q})\mathbf{a} + p\mathbf{b} + q\mathbf{c}$ represents a

(a) Straight line

(b) Plane

(c) Plane passing through the origin

(d) Sphere

98. The vector equation of the line joining the points $\mathbf{i} - 2\mathbf{j} + \mathbf{k}$ and $-2\mathbf{j} + 3\mathbf{k}$ is

(a) $\mathbf{r} = t(\mathbf{i} + \mathbf{j} + \mathbf{k})$

(b) $\mathbf{r} = t_1(\mathbf{i} - 2\mathbf{j} + \mathbf{k}) + t_2(3\mathbf{k} - 2\mathbf{j})$

(c) $\mathbf{r} = (\mathbf{i} - 2\mathbf{j} + \mathbf{k}) + t(2\mathbf{k} - \mathbf{i})$

(d) $\mathbf{r} = t(2\mathbf{k} - \mathbf{i})$

99. The spheres $\mathbf{r}^2 + 2\mathbf{u}_1.\mathbf{r} + 2d_1 = 0$ and $\mathbf{r}^2 + 2\mathbf{u}_2.\mathbf{r} + 2d_2 = 0$ cut orthogonally, if

(a) $\mathbf{u}_1.\mathbf{u}_2 = 0$

(b) $\mathbf{u}_1 + \mathbf{u}_2 = 0$

(c) $\mathbf{u}_1.\mathbf{u}_2 = d_1 + d_2$

(d) $(\mathbf{u}_1 - \mathbf{u}_2).(\mathbf{u}_1 + \mathbf{u}_2) = d_1^2 + d_2^2$

100. A tetrahedron has vertices at $O(0, 0, 0)$, $A(1, 2, 1)$, $B(2, 1, 3)$ and $C(-1, 1, 2)$. Then the angle between the faces OAB and ABC will be

(a) $\cos^{-1}\left(\frac{19}{35}\right)$ (b) $\cos^{-1}\left(\frac{17}{31}\right)$

(c) $30°$ (d) $90°$

101. Three forces of magnitudes 1, 2, 3 dynes meet in a point and act along diagonals of three adjacent faces of a cube. The resultant force is

(a) 114 dyne (b) 6 dyne

(c) 5 dyne (d) None of these

102. The vectors **b** and **c** are in the direction of north-east and north-west respectively and $|\mathbf{b}| = |\mathbf{c}| = 4$. The magnitude and direction of the vector $\mathbf{d} = \mathbf{c} - \mathbf{b}$, are

(a) $4\sqrt{2}$, towards north (b) $4\sqrt{2}$, towards west

(c) 4, towards east (d) 4, towards south

103. If **a, b** and **c** are unit vectors, then $|\mathbf{a} - \mathbf{b}|^2 + |\mathbf{b} - \mathbf{c}|^2 + |\mathbf{c} - \mathbf{a}|^2$ does not exceed

(a) 4 (b) 9

(c) 8 (d) 6

104. The vectors $\overrightarrow{AB} = 3\mathbf{i} + 5\mathbf{j} + 4\mathbf{k}$ and $\overrightarrow{AC} = 5\mathbf{i} - 5\mathbf{j} + 2\mathbf{k}$ are the sides of a triangle ABC. The length of the median through A is

(a) $\sqrt{13}$ *unit* (b) $2\sqrt{5}$ *unit*

(c) 5 *unit* (d) 10 *unit*

105. Let the value of $\mathbf{p} = (x + 4y)\mathbf{a} + (2x + y + 1)\mathbf{b}$ and $\mathbf{q} = (y - 2x + 2)\mathbf{a} + (2x - 3y - 1)\mathbf{b}$, where **a** and **b** are non-collinear vectors. If $3\mathbf{p} = 2\mathbf{q}$, then the value of x and y will be

(a) – 1, 2 (b) 2, – 1

(c) 1, 2 (d) 2, 1

106. If $\int_0^{t^2} xf(x)dx = \frac{2}{5}t^5$, $t > 0$, then $f\left(\frac{4}{25}\right) =$

(a) $\frac{2}{5}$ (b) $\frac{5}{2}$

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

107. For which of the following values of m, the area of the region bounded by the curve $y = x - x^2$ and the line $y = mx$ equals $\frac{9}{2}$

(a) -4 (b) -2

(c) 2 (d) 4

108. Area enclosed between the curve $y^2(2a-x)=x^3$ and line $x=2a$ above x-axis is

(a) πa^2 (b) $\frac{3\pi a^2}{2}$

(c) $2\pi a^2$ (d) $3\pi a^2$

109. If A and B are two independent events, then $P\left(\frac{A}{B}\right)=$

(a) 0 (b) 1

(c) $P(A)$ (d) $P(B)$

110. If E and F are independent events such that $0<P(E)<1$ and $0<P(F)<1$, then

(a) E and F^c (the complement of the event F) are independent

(b) E^c and F^c are independent

(c) $P\left(\frac{E}{F}\right)+P\left(\frac{E^c}{F^c}\right)=1$

(d) All of the above

111. If $4P(A)=6P(B)=10P(A\cap B)=1$, then $P\left(\frac{B}{A}\right)=$

(a) $\frac{2}{5}$ (b) $\frac{3}{5}$

(c) $\frac{7}{10}$ (d) $\frac{19}{60}$

112. For a biased die, the probabilities for different faces to turn up are

Face :	1	2	3	4	5	6
Probability :	0.2	0.22	0.11	0.25	0.05	0.17

The die is tossed and you are told that either face 4 or face 5 has turned up. The probability that it is face 4 is

(a) $\frac{1}{6}$ (b) $\frac{1}{4}$

(c) $\frac{5}{6}$ (d) None of these

113. If the mean and variance of a binomial variate X are 2 and 1 respectively, then the probability that X takes a value greater than 1, is

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

(c) $\frac{7}{8}$ (d) $\frac{15}{16}$

114. At least number of times a fair coin must be tossed so that the probability of getting at least one head is at least 0.8, is

(a) 7 (b) 6

(c) 5 (d) None of these

115. A square $ABCD$ of diagonal $2a$ is folded along the diagonal AC so that the planes DAC and BAC are at right angle. The shortest distance between DC and AB is

(a) $\sqrt{2}a$ (b) $2a/\sqrt{3}$

(c) $2a/\sqrt{5}$ (d) $(\sqrt{3}/2)a$

116. A line with direction cosines proportional to 2,1, 2 meets each of the lines $x=y+a=z$ and $x+a=2y=2z$. The co-ordinates of each of the points of intersection are given by

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

(c) $(3a, 2a, 3a), (a, a, 2a)$ (d) $(3a, 3a, 3a), (a, a, a)$

117. The equation of the planes passing through the line of intersection of the planes $3x-y-4z=0$ and $x+3y+6=0$ whose distance from the origin is 1, are

(a) $x-2y-2z-3=0$, $2x+y-2z+3=0$

(b) $x-2y+2z-3=0$, $2x+y+2z+3=0$

(c) $x+2y-2z-3=0$, $2x-y-2z+3=0$

(d) None of these

118. The co-ordinates of the points A and B are (2, 3, 4) (–2, 5,– 4) respectively. If a point P moves so that $PA^2-PB^2=k$ where k is a constant, then the locus of P is

(a) A line (b) A plane

(c) A sphere (d) None of these

119. The equation of the plane passing through the points $(1,-3,-2)$ and perpendicular to planes $x+2y+2z=5$ and $3x+3y+2z=8$, is

(a) $2x-4y+3z-8=0$ (b) $2x-4y-3z+8=0$

(c) $2x+4y+3z+8=0$ (d) None of these

120. The equation of the plane through the intersection of the planes $x+2y+3z-4=0$, $4x+3y+2z+1=0$ and passing through the origin will be

(a) $x+y+z=0$ (b) $17x+14y+11z=0$

(c) $7x+4y+z=0$ (d) $17x+14y+z=0$

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