1. The set of intelligent students in a class is
(a) A null set
(b) A singleton set
(c) A finite set
(d) Not a well defined collection

2. Which of the following is the empty set
(a) $\{x : x$ is a real number and $x^2 - 1 = 0\}$
(b) $\{x : x$ is a real number and $x^2 + 1 = 0\}$
(c) $\{x : x$ is a real number and $x^2 - 9 = 0\}$
(d) $\{x : x$ is a real number and $x^2 = x + 2\}$

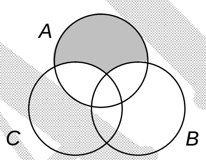
3. The set $A = \{x : x \in R, x^2 = 16$ and $2x = 6\}$ equals
(a) ϕ (b) $\{14, 3, 4\}$
(c) $\{3\}$ (d) $\{4\}$

4. If a set A has n elements, then the total number of subsets of A is
(a) n (b) n^2
(c) 2^n (d) $2n$

5. The number of proper subsets of the set {1, 2, 3} is
(a) 8 (b) 7
(c) 6 (d) 5

6. The relation R = {(1, 1), (2, 2), (3, 3), (1, 2), (2, 3), (1, 3)} on set A = {1, 2, 3} is
(a) Reflexive but not symmetric
(b) Reflexive but not transitive
(c) Symmetric and Transitive
(d) Neither symmetric nor transitive

7. The shaded region in the given figure is
(a) $A \cap (B \cup C)$
(b) $A \cup (B \cap C)$
(c) $A \cap (B - C)$
(d) $A - (B \cup C)$



8. Let $P = \{(x, y) \mid x^2 + y^2 = 1, x, y \in R\}$. Then P is
(a) Reflexive (b) Symmetric
(c) Transitive (d) Anti-symmetric

9. Let R be an equivalence relation on a finite set A having n elements. Then the number of ordered pairs in R is
(a) Less than n
(b) Greater than or equal to n
(c) Less than or equal to n
(d) None of these

10. For real numbers x and y, we write $xRy \Leftrightarrow x - y + \sqrt{2}$ is an irrational number. Then the relation R is
(a) Reflexive (b) Symmetric
(c) Transitive (d) None of these

11. If $x^2 + y^2 = 25, xy = 12$, then $x =$
(a) {3, 4} (b) {3, –3}
(c) {3, 4, –3, –4} (d) {–3, –3}

12. The solution set of the equation $x^{\log_x (1-x)^2} = 9$ is
(a) {– 2, 4} (b) {4}
(c) {0, – 2, 4} (d) None of these

13. Let one root of $ax^2 + bx + c = 0$ where a, b, c are integers be $3 + \sqrt{5}$, then the other root is
(a) $3 - \sqrt{5}$ (b) 3
(c) $\sqrt{5}$ (d) None of these

14. The number of real solutions of the equation $|x|^2 - 3|x| + 2 = 0$ are
(a) 1 (b) 2
(c) 3 (d) 4

15. The number of real roots of the equation $e^{\sin x} - e^{-\sin x} - 4 = 0$ are
(a) 1 (b) 2
(c) Infinite (d) None

16. If the sum of the roots of the equation $ax^2 + bx + c = 0$ be equal to the sum of their squares, then
(a) $a(a + b) = 2bc$ (b) $c(a + c) = 2ab$
(c) $b(a + b) = 2ac$ (d) $b(a + b) = ac$

17. If the roots of the equation $\frac{\alpha}{x - \alpha} + \frac{\beta}{x - \beta} = 1$ be equal in magnitude but opposite in sign, then $\alpha + \beta$ =
(a) 0 (b) 1
(c) 2 (d) None of these

18. If α, β be the roots of the equation $x^2 - 2x + 3 = 0$, then the equation whose roots are $\frac{1}{\alpha^2}$ and $\frac{1}{\beta^2}$ is
(a) $x^2 + 2x + 1 = 0$ (b) $9x^2 + 2x + 1 = 0$
(c) $9x^2 - 2x + 1 = 0$ (d) $9x^2 + 2x - 1 = 0$

19. If α, β are the roots of $x^2 + px + 1 = 0$ and γ, δ are the roots of $x^2 + qx + 1 = 0$, then $q^2 - p^2$ =
(a) $(\alpha - \gamma)(\beta - \gamma)(\alpha + \delta)(\beta + \delta)$
(b) $(\alpha + \gamma)(\beta + \gamma)(\alpha - \delta)(\beta + \delta)$
(c) $(\alpha + \gamma)(\beta + \gamma)(\alpha + \delta)(\beta + \delta)$
(d) None of these

20. If α, β be the roots of $x^2 - px + q = 0$ and α', β' be the roots of $x^2 - p'x + q' = 0$, then the value of $(\alpha - \alpha')^2 + (\beta - \alpha')^2 + (a - \beta')^2 + (\beta - \beta')^2$ is

(a) $2\{p^2-2q+p'^2-2q'-pp'\}$

(b) $2\{p^2-2q+p'^2-2q'-qq'\}$

(c) $2\{p^2-2q-p'^2-2q'-pp'\}$

(d) $2\{p^2-2q-p'^2-2q'-qq'\}$

21. If two roots of the equation $x^3-3x+2=0$ are same, then the roots will be

(a) 2, 2, 3 (b) 1, 1, –2

(c) – 2, 3, 3 (d) –2, –2, 1

22. If a,b,c are real and $x^3-3b^2x+2c^3$ is divisible by $x-a$ and $x-b$, then

(a) $a=-b=-c$ (b) $a=2b=2c$

(c) $a=b=c$, $a=-2b=-2c$ (d) None of these

23. If $z=x+iy, z^{1/3}=a-ib$ and $\frac{x}{a}-\frac{y}{b}=k(a^2-b^2)$ then value of k equals

(a) 2 (b) 4

(c) 6 (d) 1

24. If $\frac{c+i}{c-i}=a+ib$, where a,b,c are real, then $a^2+b^2=$

(a) 1 (b) –1

(c) c^2 (d) $-c^2$

25. If the conjugate of $(x+iy)(1-2i)$ be $1+i$, then

(a) $x=\frac{1}{5}$ (b) $y=\frac{3}{5}$

(c) $x+iy=\frac{1-i}{1-2i}$ (d) $x-iy=\frac{1-i}{1+2i}$

26. The coefficient of x^n in the expansion of $(1+x+x^2+....)^{-n}$ is

(a) 1 (b) $(-1)^n$

(c) n (d) $n+1$

27. For all positive integral values of n, $3^{2n}-2n+1$ is divisible by

(a) 2 (b) 4

(c) 8 (d) 12

28. The number of way to sit 3 men and 2 women in a bus such that total number of sitted men and women on each side is 3

(a) 5! (b) ${}^6C_5\times 5!$

(c) $6!\times{}^6P_5$ (d) $5!+{}^6C_5$

29. If a_m denotes the m^{th} term of an A.P. then a_m =

(a) $\frac{2}{a_{m+k}+a_{m-k}}$ (b) $\frac{a_{m+k}-a_{m-k}}{2}$

(c) $\frac{a_{m+k}+a_{m-k}}{2}$ (d) None of these

30. Let T_r be the r^{th} term of an A.P. for $r=1,2,3,....$. If for some positive integers m,n we have $T_m=\frac{1}{n}$ and $T_n=\frac{1}{m}$, then T_{mn} equals

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

(c) 1 (d) 0

31. The equation of the lines represented by the equation $x^2-5xy+6y^2=0$ are

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

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

32. If the vertices of a triangle are $A(1,4), B(3,0)$ and $C(2,1)$, then the length of the median passing through C is

(a) 1 (b) 2

(c) $\sqrt{2}$ (d) $\sqrt{3}$

33. Three vertices of a parallelogram taken in order are $(-1,-6)$, $(2,-5)$ and $(7,2)$. The fourth vertex is

(a) (1, 4) (b) (4, 1)

(c) (1, 1) (d) (4, 4)

34. P and Q are points on the line joining A (–2, 5) and B (3, 1) such that AP = PQ = QB. Then the mid-point of PQ is

(a) $\left(\frac{1}{2},3\right)$ (b) $\left(-\frac{1}{2},4\right)$

(c) $(2,3)$ (d) $(1,4)$

35. The points of trisection of the line segment joining the points (3, –2) and (–3, –4) are

(a) $\left(\frac{3}{2},-\frac{5}{2}\right),\left(-\frac{3}{2},-\frac{13}{4}\right)$ (b) $\left(-\frac{3}{2},\frac{5}{2}\right),\left(\frac{3}{2},\frac{13}{4}\right)$

(c) $\left(1,-\frac{8}{3}\right),\left(-1,-\frac{10}{3}\right)$ (d) None of these

36. The equation of a line through the intersection of lines $x=0$ and $y=0$ and through the point (2, 2), is

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

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

37. Equation of a line through the origin and perpendicular to, the line joining (a, 0) and (– a, 0), is

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

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

38. The equation of circle passing through (4, 5) and having the centre at (2, 2), is

(a) $x^2+y^2+4x+4y-5=0$

(b) $x^2+y^2-4x-4y-5=0$

(c) $x^2+y^2-4x=13$

(d) $x^2+y^2-4x-4y+5=0$

39. A circle touches x-axis and cuts off a chord of length $2l$ from y-axis. The locus of the centre of the circle is
(a) A straight line (b) A circle
(c) An ellipse (d) A hyperbola

40. The equation of parabola whose vertex and focus are (0, 4) and (0, 2) respectively, is
(a) $y^2 - 8x = 32$ (b) $y^2 + 8x = 32$
(c) $x^2 + 8y = 32$ (d) $x^2 - 8y = 32$

41. P is any point on the ellipse $9x^2 + 36y^2 = 324$, whose foci are S and S'. Then $SP + S'P$ equals
(a) 3 (b) 12
(c) 36 (d) 324

42. The equation $x^2 - 16xy - 11y^2 - 12x + 6y + 21 = 0$ represents
(a) Parabola (b) Ellipse
(c) Hyperbola (d) Two straight lines

43. If $2y\cos\theta = x\sin\theta$ and $2x\sec\theta - y\,\text{cosec}\,\theta = 3$, then $x^2 + 4y^2 =$
(a) 4 (b) – 4
(c) ± 4 (d) None of these

44. If $\tan A + \cot A = 4$, then $\tan^4 A + \cot^4 A$ is equal to
(a) 110 (b) 191
(c) 80 (d) 194

45. If $x = \sec\phi - \tan\phi, y = \text{cosec}\,\phi + \cot\phi$, then
(a) $x = \frac{y+1}{y-1}$ (b) $x = \frac{y-1}{y+1}$
(c) $y = \frac{1-x}{1+x}$ (d) None of these

46. The value of $a\cos\theta + b\sin\theta$ lies between
(a) $a - b$ and $a + b$
(b) a and b
(c) $-(a^2 + b^2)$ and $(a^2 + b^2)$
(d) $-\sqrt{a^2 + b^2}$ and $\sqrt{a^2 + b^2}$

47. The maximum value of $3\cos\theta - 4\sin\theta$ is
(a) 3 (b) 4
(c) 5 (d) None of these

48. Minimum value of $5\sin^2\theta + 4\cos^2\theta$ is
(a) 1 (b) 2
(c) 3 (d) 4

49. The maximum value of $\cos^2\left(\frac{\pi}{3} - x\right) - \cos^2\left(\frac{\pi}{3} + x\right)$ is
(a) $-\frac{\sqrt{3}}{2}$ (b) $\frac{1}{2}$
(c) $\frac{\sqrt{3}}{2}$ (d) $\frac{3}{2}$

50. $\tan^2\theta + \cot^2\theta$ is
(a) ≥ 2 (b) ≤ 2
(c) ≥ -2 (d) None of these

51. If $4\sin^4 x + \cos^4 x = 1$, then $x =$
(a) $n\pi$ (b) $n\pi \pm \sin^{-1}\frac{2}{5}$
(c) $n\pi + \frac{\pi}{6}$ (d) None of these

52. If $\cos 3x + \sin\left(2x - \frac{7\pi}{6}\right) = -2$, then $x =$ (where $k \in Z$)
(a) $\frac{\pi}{3}(6k + 1)$ (b) $\frac{\pi}{3}(6k - 1)$
(c) $\frac{\pi}{3}(2k + 1)$ (d) None of these

53. A ladder 5 *metre* long leans against a vertical wall. The bottom of the ladder is 3 *metre* from the wall. If the bottom of the ladder is pulled 1 *metre* farther from the wall, how much does the top of the ladder slide down the wall
(a) 1 m (b) 7 m
(c) 2 m (d) None of these

54. Domain and range of $f(x) = \frac{|x-3|}{x-3}$ are respectively
(a) $R, [-1, 1]$ (b) $R - \{3\}, \{1, -1\}$
(c) R^+, R (d) None of these

55. If in greatest integer function, the domain is a set of real numbers, then range will be set of
(a) Real numbers (b) Rational numbers
(c) Imaginary numbers (d) Integers

56. If $f(a) = 2, f'(a) = 1, g(a) = -1; g'(a) = 2$, then $\lim_{x \to a} \frac{g(x)f(a) - g(a)f(x)}{x - a} =$
(a) 3 (b) 5
(c) 0 (d) –3

57. $\lim_{x \to \alpha} \frac{\sin x - \sin\alpha}{x - \alpha} =$
(a) 0 (b) 1
(c) $\sin\alpha$ (d) $\cos\alpha$

58. The function $f(x) = \sin|x|$ is

(a) Continuous for all x
(b) Continuous only at certain points
(c) Differentiable at all points
(d) None of these

59. If $f(x) = \begin{cases} ax^2 + b; & x \le 0 \\ x^2; & x > 0 \end{cases}$ possesses derivative at $x = 0$, then

(a) $a = 0, b = 0$ (b) $a > 0, = 0$
(c) $a \in R, = 0$ (d) None of these

60. The set of all those points, where the function $f(x) = \frac{x}{1+|x|}$ is differentiable, is

(a) $(-\infty, \infty)$ (b) $[0, \infty]$
(c) $(-\infty, 0) \cup (0, \infty)$ (d) $(0, \infty)$

61. If $y = \sin(\sqrt{\sin x + \cos x})$, then $\frac{dy}{dx} =$

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

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

(a) $\frac{4x}{1-x^2}.\cos\left(\frac{1+x^2}{1-x^2}\right)$ (b) $\frac{x}{(1-x^2)^2}.\cos\left(\frac{1+x^2}{1-x^2}\right)$
(c) $\frac{x}{(1-x^2)}.\cos\left(\frac{1+x^2}{1-x^2}\right)$ (d) $\frac{4x}{(1-x^2)^2}.\cos\left(\frac{1+x^2}{1-x^2}\right)$

63. If $y = \sqrt{\frac{1+\tan x}{1-\tan x}}$, then $\frac{dy}{dx} =$

(a) $\frac{1}{2}\sqrt{\frac{1-\tan x}{1+\tan x}}.\sec^2\left(\frac{\pi}{4}+x\right)$ (b) $\sqrt{\frac{1-\tan x}{1+\tan x}}.\sec^2\left(\frac{\pi}{4}+x\right)$
(c) $\frac{1}{2}\sqrt{\frac{1-\tan x}{1+\tan x}}.\sec\left(\frac{\pi}{4}+x\right)$ (d) None of these

64. The triangle formed by the tangent to the curve $f(x) = x^2 + bx - b$ at the point (1, 1) and the co-ordinate axes, lies in the first quadrant. If its area is 2 then the value of b is

(a) –1 (b) 3
(c) –3 (d) 1

65. The line $2x + \sqrt{6}y = 2$ is a tangent to the curve $x^2 - 2y^2 = 4$. The point of contact is

(a) $(4, -\sqrt{6})$ (b) $(7, -2\sqrt{6})$
(c) $(2,3)$ (d) $(\sqrt{6},1)$

66. The function $\frac{(e^{2x}-1)}{(e^{2x}+1)}$ is

(a) Increasing (b) Decreasing
(c) Even (d) Odd

67. Let $f(x) = \int e^x(x-1)(x-2)dx$. Then f decreases in the interval

(a) $(-\infty,-2)$ (b) $(-2,-1)$
(c) $(1, 2)$ (d) $(2,+\infty)$

68. If for $f(x) = 2x - x^2$, Lagrange's theorem satisfies in [0, 1], then the value of $c \in [0,1]$ is

(a) $c = 0$ (b) $c = \frac{1}{2}$
(c) $c = \frac{1}{4}$ (d) $c = 1$

69. If the function $f(x) = ax^3 + bx^2 + 11x - 6$ satisfies the conditions of Rolle's theorem for the interval [1, 3] and $f'\left(2 + \frac{1}{\sqrt{3}}\right) = 0$, then the values of a and b are respectively

(a) 1, – 6 (b) – 2, 1
(c) – 1, $\frac{1}{2}$ (d) – 1, 6

70. If $z = y + f(v)$, where $v = \left(\frac{x}{y}\right)$ then $v\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y}$ is

(a) –1 (b) 1
(c) 0 (d) 2

71. The value of $\int \frac{1}{(x-5)^2}\,dx$ is

(a) $\frac{1}{x-5} + c$ (b) $-\frac{1}{x-5} + c$
(c) $\frac{2}{(x-5)^3} + c$ (d) $-2(x-5)^3 + c$

72. If $\int f(x)dx = f(x)$, then $\int [f(x)]^2\,dx$ is

(a) $\frac{1}{2}[f(x)]^2$ (b) $[f(x)]^3$
(c) $\frac{[f(x)]^3}{3}$ (d) $[f(x)]^2$

73. If for non-zero x, $af(x)+bf\left(\frac{1}{x}\right)=\frac{1}{x}-5$, where $a \neq b$, then $\int_1^2 f(x)dx =$

(a) $\frac{1}{(a^2+b^2)}\left[a\log 2-5a+\frac{7}{2}b\right]$

(b) $\frac{1}{(a^2-b^2)}\left[a\log 2-5a+\frac{7}{2}b\right]$

(c) $\frac{1}{(a^2-b^2)}\left[a\log 2-5a-\frac{7}{2}b\right]$

(d) $\frac{1}{(a^2+b^2)}\left[a\log 2-5a-\frac{7}{2}b\right]$

74. If $I_n=\int_0^{\pi/4}\tan^n\theta\,d\theta$, then I_8+I_6 equals

(a) $\frac{1}{4}$ (b) $\frac{1}{5}$

(c) $\frac{1}{6}$ (d) $\frac{1}{7}$

75. If the area bounded by $y=ax^2$ and $x=ay^2$, $a>0$, is 1, then $a=$

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

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

76. The solution of the differential equation $x\frac{dy}{dx}=y(\log y-\log x+1)$ is

(a) $y=xe^{cx}$ (b) $y+xe^{cx}=0$

(c) $y+e^x=0$ (d) None of these

77. The solution of the differential equation $\frac{dy}{dx}=\frac{y}{x}+\frac{\phi\left(\frac{y}{x}\right)}{\phi'\left(\frac{y}{x}\right)}$ is

(a) $\phi\left(\frac{y}{x}\right)=kx$ (b) $x\phi\left(\frac{y}{x}\right)=k$

(c) $\phi\left(\frac{y}{x}\right)=ky$ (d) $y\phi\left(\frac{y}{x}\right)=k$

78. The general solution of $y^2\,dx+(x^2-xy+y^2)\,dy=0$ is

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

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

(c) $\log(y+\sqrt{x^2+y^2})+\log y+c=0$

(d) $\sinh^{-1}\left(\frac{x}{y}\right)+\log y+c=0$

79. The solution of the equation $\frac{dy}{dx}=\frac{1}{x+y+1}$ is

(a) $x=ce^y-y-2$ (b) $y=x+ce^y-2$

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

80. The solution of the given differential equation $\frac{dy}{dx}+2xy=y$ is

(a) $y=ce^{x-x^2}$ (b) $y=ce^{x^2-x}$

(c) $y=ce^x$ (d) $y=ce^{-x^2}$

81. Let A and B be two events such that $P(\overline{A\cup B})=\frac{1}{6}, P(A\cap B)=\frac{1}{4}$ and $P(\overline{A})=\frac{1}{4}$, where $\overline{A}$ stands for complement of event A. Then events A and B are

(a) Independent but not equally likely

(b) Mutually exclusive and independent

(c) Equally likely and mutually exclusive

(d) Equally likely but not independent

82. Let S be a set containing n elements and we select 2 subsets A and B of S at random then the probability that $A\cup B=S$ and $A\cap B=\phi$ is

(a) 2^n (b) n^2

(c) $1/n$ (d) $1/2^n$

83. Let A and B are two events and $P(A')=0.3$, $P(B)=0.4, P(A\cap B')=0.5$, then $P(A\cup B')$ is

(a) 0.5 (b) 0.8

(c) 1 (d) 0.1

84. If A and B are events such that $P(A\cup B)=3/4$, $P(A\cap B)=1/4$, $P(\overline{A})=2/3$, then $P(\overline{A}\cap B)$ is

(a) $\frac{5}{12}$ (b) $\frac{3}{8}$

(c) $\frac{5}{8}$ (d) $\frac{1}{4}$

85. A random variable X has the probability distribution

X	1	2	3	4	5	6	7	8
$P(X)$	0.15	0.23	0.12	0.10	0.20	0.08	0.07	0.05

For the events $E=\{X$ is prime number$\}$ and $F=\{X<4\}$, the probability of $P(E\cup F)$ is

(a) 0.50 (b) 0.77

(c) 0.35 (d) 0.87

86. $[(\mathbf{a}\times\mathbf{b})\times(\mathbf{b}\times\mathbf{c})(\mathbf{b}\times\mathbf{c})\times(\mathbf{c}\times\mathbf{a})(\mathbf{c}\times\mathbf{a})\times(\mathbf{a}\times\mathbf{b})]=$

(a) $[\mathbf{a}\ \mathbf{b}\ \mathbf{c}]^2$ (b) $[\mathbf{a}\ \mathbf{b}\ \mathbf{c}]^3$

(c) $[\mathbf{a}\ \mathbf{b}\ \mathbf{c}]^4$ (d) None of these

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87. Unit vectors **a, b** and **c** are coplanar. A unit vector **d** is perpendicular to them. If $(\mathbf{a}\times\mathbf{b})\times(\mathbf{c}\times\mathbf{d})=\frac{1}{6}\mathbf{i}-\frac{1}{3}\mathbf{j}+\frac{1}{3}\mathbf{k}$ and the angle between **a** and **b** is 30^o, then **c** is

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

(c) $\frac{(-\mathbf{i}+2\mathbf{j}-2\mathbf{k})}{3}$ (d) $\frac{(-\mathbf{i}+2\mathbf{j}+\mathbf{k})}{3}$

88. The radius of the circular section of the sphere $|\mathbf{r}|=5$ by the plane $\mathbf{r}.(\mathbf{i}+\mathbf{j}+\mathbf{k})=3\sqrt{3}$ is

(a) 1 (b) 2

(c) 3 (d) 4

89. If **x** is parallel to **y** and **z** where $\mathbf{x}=2\mathbf{i}+\mathbf{j}+\alpha\mathbf{k}$, $\mathbf{y}=\alpha\mathbf{i}+\mathbf{k}$ and $\mathbf{z}=5\mathbf{i}-\mathbf{j}$, then α is equal to

(a) $\pm\sqrt{5}$ (b) $\pm\sqrt{6}$

(c) $\pm\sqrt{7}$ (d) None of these

90. The vector **c** directed along the internal bisector of the angle between the vectors $\mathbf{a}=7\mathbf{i}-4\mathbf{j}-4\mathbf{k}$ and $\mathbf{b}=-2\mathbf{i}-\mathbf{j}+2\mathbf{k}$ with $|\mathbf{c}|=5\sqrt{6}$, is

(a) $\frac{5}{3}(\mathbf{i}-7\mathbf{j}+2\mathbf{k})$ (b) $\frac{5}{3}(5\mathbf{i}+5\mathbf{j}+2\mathbf{k})$

(c) $\frac{5}{3}(\mathbf{i}+7\mathbf{j}+2\mathbf{k})$ (d) $\frac{5}{3}(-5\mathbf{i}+5\mathbf{j}+2\mathbf{k})$

91. The distance of the point $B(\mathbf{i}+2\mathbf{j}+3\mathbf{k})$ from the line which is passing through $A(4\mathbf{i}+2\mathbf{j}+2\mathbf{k})$ and which is parallel to the vector $\vec{C}=2\mathbf{i}+3\mathbf{j}+6\mathbf{k}$ is

(a) 10 (b) $\sqrt{10}$

(c) 100 (d) None of these

92. Let **a, b, c** are three non-coplanar vectors such that

$\mathbf{r}_1=\mathbf{a}-\mathbf{b}+\mathbf{c},\ \mathbf{r}_2=\mathbf{b}+\mathbf{c}-\mathbf{a},\ \mathbf{r}_3=\mathbf{c}+\mathbf{a}+\mathbf{b}$,

$\mathbf{r}=2\mathbf{a}-3\mathbf{b}+4\mathbf{c}$. If $\mathbf{r}=\lambda_1\mathbf{r}_1+\lambda_2\mathbf{r}_2+\lambda_3\mathbf{r}_3$, then

(a) $\lambda_1=7$ (b) $\lambda_1+\lambda_3=3$

(c) $\lambda_1+\lambda_2+\lambda_3=4$ (d) $\lambda_3+\lambda_2=2$

93. Let $\mathbf{a}=2\mathbf{i}+\mathbf{j}+\mathbf{k},\ \mathbf{b}=\mathbf{i}+2\mathbf{j}-\mathbf{k}$ and a unit vector **c** be coplanar. If **c** is perpendicular to **a**, then **c** =

(a) $\frac{1}{\sqrt{2}}(-\mathbf{j}+\mathbf{k})$ (b) $\frac{1}{\sqrt{3}}(-\mathbf{i}-\mathbf{j}-\mathbf{k})$

(c) $\frac{1}{\sqrt{5}}(\mathbf{i}-2\mathbf{j})$ (d) $\frac{1}{\sqrt{3}}(\mathbf{i}-\mathbf{j}-\mathbf{k})$

94. Let **p, q, r** be three mutually perpendicular vectors of the same magnitude. If a vector **x** satisfies equation $\mathbf{p}\times\{(\mathbf{x}-\mathbf{q})\times\mathbf{p}\}+\mathbf{q}\times\{(\mathbf{x}-\mathbf{r})\times\mathbf{q}\}+\mathbf{r}\times\{(\mathbf{x}-\mathbf{p})\times\mathbf{r}\}=0$, then **x** is given by

(a) $\frac{1}{2}(\mathbf{p}+\mathbf{q}-2\mathbf{r})$ (b) $\frac{1}{2}(\mathbf{p}+\mathbf{q}+\mathbf{r})$

(c) $\frac{1}{3}(\mathbf{p}+\mathbf{q}+\mathbf{r})$ (d) $\frac{1}{3}(2\mathbf{p}+\mathbf{q}-\mathbf{r})$

95. The point of intersection of $\mathbf{r}\times\mathbf{a}=\mathbf{b}\times\mathbf{a}$ and $\mathbf{r}\times\mathbf{b}=\mathbf{a}\times\mathbf{b}$, where $\mathbf{a}=\mathbf{i}+\mathbf{j}$ and $\mathbf{b}=2\mathbf{i}-\mathbf{k}$ is

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

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

96. The direction cosines of a line segment *AB* are $-2/\sqrt{17},\ 3/\sqrt{17},\ -2/\sqrt{17}$. If $AB=\sqrt{17}$ and the co-ordinates of *A* are (3, –6, 10), then the co-ordinates of *B* are

(a) (1, –2, 4) (b) (2, 5, 8)

(c) (–1, 3, –8) (d) (1, – 3, 8)

97. The projection of any line on co-ordinate axes be respectively 3, 4, 5 then its length is

(a) 12 (b) 50

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

98. If centroid of the tetrahedron *OABC*, where *A*, *B*, *C* are given by (*a*, 2, 3),(1, *b*, 2) and (2, 1, *c*) respectively be (1, 2, –1), then distance of $P(a,b,c)$ from origin is equal to

(a) $\sqrt{107}$ (b) $\sqrt{14}$

(c) $\sqrt{107/14}$ (d) None of these

99. If $P\equiv(0,1,0), Q\equiv(0,0,1)$, then projection of *PQ* on the plane $x+y+z=3$ is

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

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

100. The points $A(4,5,1), B(0,-1,-1), C(3,9,4)$ and $D(-4,4,4)$ are

(a) Collinear

(b) Coplanar

(c) Non- coplanar

(d) Non- Collinear and non-coplanar

101. If the lines $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z-1}{4}$ and $\frac{x-3}{1}=\frac{y-k}{1}=\frac{z}{1}$ intersect, then k =

(a) $\frac{2}{9}$ (b) $\frac{9}{2}$

(c) 0 (d) None of these

102. A variable plane at a constant distance p from origin meets the co-ordinates axes in A, B, C. Through these points planes are drawn parallel to co-ordinate planes. Then locus of the point of intersection is

(a) $\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2}=\frac{1}{p^2}$ (b) $x^2+y^2+z^2=p^2$

(c) $x+y+z=p$ (d) $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=p$

103. The value of k such that $\frac{x-4}{1}=\frac{y-2}{1}=\frac{z-k}{2}$ lies in the plane $2x-4y+z=7$, is

(a) 7 (b) – 7

(c) No real value (d) 4

104. The shortest distance from the plane $12x+4y+3z=327$ to the sphere $x^2+y^2+z^2+4x-2y-6z=155$ is

(a) 26 (b) $11\frac{4}{13}$

(c) 13 (d) 39

105. If the line of action of the resultant of two forces P and Q divides the angle between them in the ratio 1 : 2, then the magnitude of the resultant is

(a) $\frac{P^2+Q^2}{P}$ (b) $\frac{P^2+Q^2}{Q}$

(c) $\frac{P^2-Q^2}{P}$ (d) $\frac{P^2-Q^2}{Q}$

106. P and Q are like parallel forces. If P is moved parallel to itself through a distance x, then the resultant of P and Q moves through a distance

(a) $\frac{Px}{P+Q}$ (b) $\frac{Px}{P-Q}$

(c) $\frac{Px}{P+2Q}$ (d) None of these

107. At what height from the base of a vertical pillar, a string of length 6 *metres* be tied, so that a man sitting on the ground and pulling the other end of the string has to apply minimum force to overturn the pillar

(a) 1.5 *metres* (b) $3\sqrt{2}$ *metres*

(c) $3\sqrt{3}$ *metres* (d) $4\sqrt{2}$ *metres*

108. Two smooth beads A and B, free to move on a vertical smooth circular wire, are connected by a string. Weights W_1, W_2 and W are suspended from A, B and a point C of the string respectively. In equilibrium, A and B are in a horizontal line. If $\angle BAC=\alpha$ and $\angle ABC=\beta$, then the ratio $\tan\alpha:\tan\beta$ is

(a) $\frac{\tan\alpha}{\tan\beta}=\frac{W-W_1+W_2}{W+W_1-W_2}$ (b) $\frac{\tan\alpha}{\tan\beta}=\frac{W+W_1-W_2}{W-W_1+W_2}$

(c) $\frac{\tan\alpha}{\tan\beta}=\frac{W+W_1+W_2}{W+W_1-W_2}$ (d) None of these

109. A beam whose centre of gravity divides it into two portions a and b, is placed inside a smooth horizontal sphere. If θ be its inclination to the horizon in the position of equilibrium and 2α be the angle subtended by the beam at the centre of the sphere, then

(a) $\tan\theta=(b-a)(b+a)\tan\alpha$

(b) $\tan\theta=\frac{(b-a)}{(b+a)}\tan\alpha$

(c) $\tan\theta=\frac{(b+a)}{(b-a)}\tan\alpha$

(d) $\tan\theta=\frac{1}{(b-a)(b+a)}\tan\alpha$

110. A block of mass 2 *kg* slides down a rough inclined plane starting from rest at the top. If the inclination of the plane to the horizontal is θ with $\tan\theta=\frac{4}{5}$, the coefficient of friction is 0.3 and the acceleration due to gravity is g = 9.8m/sec^2. The velocity of the block when it reaches the bottom is

(a) 6.3 (b) 5.2

(c) 7 (d) 8.1

111. 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) 4

(c) 3 (d) 2

112. If $A=\begin{vmatrix}1&1&1\\a&b&c\\a^3&b^3&c^3\end{vmatrix}, B=\begin{vmatrix}1&1&1\\a^2&b^2&c^2\\a^3&b^3&c^3\end{vmatrix}, C=\begin{vmatrix}a&b&c\\a^2&b^2&c^2\\a^3&b^3&c^3\end{vmatrix}$, then which relation is correct

(a) $A=B$ (b) $A=C$

(c) $B=C$ (d) None of these

113. If A_1, B_1, C_1 .... are respectively the co-factors of the elements a_1, b_1, c_1 ,...... of the determinant

$\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$, then $\begin{vmatrix} B_2 & C_2 \\ B_3 & C_3 \end{vmatrix} =$

(a) $a_1\Delta$ (b) $a_1 a_3 \Delta$
(c) $(a_1 + b_1)\Delta$ (d) None of these

114. Let $A = [a_{ij}]_{n\times n}$ be a square matrix and let c_{ij} be cofactor of a_{ij} in A. If $C = [c_{ij}]$,then

(a) $|C| = |A|$ (b) $|C| = |A|^{n-1}$
(c) $|C| = |A|^{n-2}$ (d) None of these

115. $\begin{vmatrix} \log_2 512 & \log_4 3 \\ \log_3 8 & \log_4 9 \end{vmatrix} \times \begin{vmatrix} \log_2 3 & \log_8 3 \\ \log_3 4 & \log_3 4 \end{vmatrix} =$

(a) 7 (b) 10
(c) 13 (d) 17

116. If A is a symmetric matrix, then matrix $M'AM$ is
(a) Symmetric (b) Skew-symmetric
(c) Hermitian (d) Skew-Hermitian

117. An orthogonal matrix is

(a) $\begin{bmatrix} \cos\alpha & 2\sin\alpha \\ -2\sin\alpha & \cos\alpha \end{bmatrix}$ (b) $\begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$

(c) $\begin{bmatrix} \cos\alpha & \sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$ (d) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

118. If $A = \begin{bmatrix} a & c \\ d & b \end{bmatrix}$, then $A^{-1} =$

(a) $\frac{1}{ab-cd}\begin{bmatrix} b & -c \\ -d & a \end{bmatrix}$ (b) $\frac{1}{ad-bc}\begin{bmatrix} b & -c \\ -d & a \end{bmatrix}$

(c) $\frac{1}{ab-cd}\begin{bmatrix} b & d \\ c & a \end{bmatrix}$ (d) None of these

119. The inverse of the matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ is

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

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

120. The inverse of $\begin{bmatrix} 2 & -3 \\ -4 & 2 \end{bmatrix}$ is

(a) $\frac{-1}{8}\begin{bmatrix} 2 & 3 \\ 4 & 2 \end{bmatrix}$ (b) $\frac{-1}{8}\begin{bmatrix} 3 & 2 \\ 2 & 4 \end{bmatrix}$

(c) $\frac{1}{8}\begin{bmatrix} 2 & 3 \\ 4 & 2 \end{bmatrix}$ (d) $\frac{1}{8}\begin{bmatrix} 3 & 2 \\ 2 & 4 \end{bmatrix}$

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