1. The resultant of two forces 3P and 2P is R, if the first force is doubled, the resultant is also doubled. The angle between the forces is

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

(c) $\frac{\pi}{6}$ (d) $\frac{5\pi}{6}$

2. The resultant of two forces $\vec{P}$ and $\vec{Q}$ is of magnitude P. If the force $\vec{P}$ is doubled, $\vec{Q}$ remaining unaltered, the new resultant will be

(a) Along $\vec{P}$ (b) Along $\vec{Q}$

(c) At 60^o to $\vec{Q}$ (d) At right angle to $\vec{Q}$

3. P, Q, R are the points on the sides BC, CA, AB of the triangle ABC such that $BP:PC = CQ:QA = AR:RB = m:n$. If Δ denotes the area of the ΔABC, then the forces $\overrightarrow{AP}, \overrightarrow{BQ}, \overrightarrow{CR}$ reduce to a couple whose moment is

(a) $2\frac{m+n}{m-n}\Delta$ (b) $2\frac{n-m}{n+m}\Delta$

(c) $2(m^2-n^2)\Delta$ (d) $2(m^2+n^2)\Delta$

4. If the resultant of forces P,Q,R acting along the sides BC, CA, AB of a ΔABC passes through its circumcentre, then

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

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

(c) $P\sec A + Q\sec B + R\sec C = 0$

(d) $P\tan A + Q\tan B + R\tan C = 0$

5. A system of five forces whose directions and non-zero magnitudes can be chosen arbitrarily, will never be in equilibrium if n of the forces are concurrent, where

(a) $n=2$ (b) $n=3$

(c) $n=4$ (d) $n=5$

6. The minimum force required to move a body of weight W placed on a rough horizontal plane surface is

(a) $W\sin\lambda$ (b) $W\cos\lambda$

(c) $W\tan\lambda$ (d) $W\cot\lambda$

7. A body of weight 4 kg is kept in a plane inclined at an angle of 30^o to the horizontal. It is in limiting equilibrium. The coefficient of friction is then equal to

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

(c) $\frac{1}{4\sqrt{3}}$ (d) $\frac{\sqrt{3}}{4}$

8. If $A = \begin{bmatrix} 2 & 2 \\ a & b \end{bmatrix}$ and $A^2 = O$, then $(a,b) =$

(a) $(-2,-2)$ (b) $(2,-2)$

(c) $(-2,2)$ (d) $(2,2)$

9. If $[m\ \ n]\begin{bmatrix} m \\ n \end{bmatrix} = [25]$ and m< n, then (m, n) =

(a) (2, 3) (b) (3, 4)

(c) (4, 3) (d) None of these

10. $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix} =$

(a) $a^3+b^3+c^3-3abc$

(b) $a^3+b^3+c^3+3abc$

(c) $(a+b+c)(a-b)(b-c)(c-a)$

(d) None of these

11. With reference to a universal set, the inclusion of a subset in another, is relation, which is

(a) Symmetric only (b) Equivalence relation

(c) Reflexive only (d) None of these

12. Let R be a relation on the set N of natural numbers defined by nRm $\Leftrightarrow$ n is a factor of m (i.e., n|m). Then R is

(a) Reflexive and symmetric

(b) Transitive and symmetric

(c) Equivalence

(d) Reflexive, transitive but not symmetric

13. Let R and S be two non-void relations on a set A. Which of the following statements is false

(a) R and S are transitive $\Rightarrow$ R $\cup$ S is transitive

(b) R and S are transitive $\Rightarrow$ R $\cap$ S is transitive

(c) R and S are symmetric $\Rightarrow$ R $\cup$ S is symmetric

(d) R and S are reflexive $\Rightarrow$ R $\cap$ S is reflexive

14. Let a relation R be defined by R = {(4, 5); (1, 4); (4, 6); (7, 6); (3, 7)} then $R^{-1}oR$ is

(a) {(1, 1), (4, 4), (4, 7), (7, 4), (7, 7), (3, 3)}

(b) {(1, 1), (4, 4), (7, 7), (3, 3)}

(c) {(1, 5), (1, 6), (3, 6)}

(d) None of these

15. Let R be a relation on the set N be defined by {(x, y)| x, y $\in$ N, 2x + y = 41}. Then R is

(a) Reflexive (b) Symmetric

(c) Transitive (d) None of these

16. In a class of 55 students, the number of students studying different subjects are 23 in Mathematics, 24 in Physics, 19 in Chemistry, 12 in Mathematics and Physics, 9 in Mathematics and Chemistry, 7 in Physics and Chemistry and 4 in all the three subjects. The number of students who have taken exactly one subject is

(a) 6 (b) 9
(c) 7 (d) All of these

17. If A, B and C are any three sets, then A × (B ∪ C) is equal to

(a) (A × B) ∪ (A × C) (b) (A ∪ B) × (A ∪ C)
(c) (A × B) ∩ (A × C) (d) None of these

18. If A, B and C are any three sets, then A – (B ∪ C) is equal to

(a) (A – B) ∪ (A – C) (b) (A – B) ∩ (A – C)
(c) (A – B) ∪ C (d) (A – B) ∩ C

19. In a triangle ABC the value of $\angle A$ is given by $5\cos A+3=0$, then the equation whose roots are $\sin A$ and $\tan A$ will be

(a) $15x^2-8x+16=0$ (b) $15x^2+8x-16=0$
(c) $15x^2-8\sqrt{2}x+16=0$ (d) $15x^2-8x-16=0$

20. If one root of the equation $ax^2+bx+c=0$ the square of the other, then $a(c-b)^3=cX$, where X is

(a) a^3+b^3 (b) $(a-b)^3$
(c) a^3-b^3 (d) None of these

21. If 8, 2 are the roots of $x^2+ax+\beta=0$ and 3, 3 are the roots of $x^2+\alpha x+b=0$, then the roots of $x^2+ax+b=0$ are

(a) $8,-1$ (b) $-9, 2$
(c) $-8,-2$ (d) 9, 1

22. The set of values of x which satisfy $5x+2<3x+8$ and $\frac{x+2}{x-1}<4$, is

(a) $(2,3)$ (b) $(-\infty,1)\cup(2,3)$
(c) $(-\infty,1)$ (d) $(1,3)$

23. If α,β are the roots of $x^2-ax+b=0$ and if $\alpha^n+\beta^n=V_n$, then

(a) $V_{n+1}=aV_n+bV_{n-1}$ (b) $V_{n+1}=aV_n+aV_{n-1}$
(c) $V_{n+1}=aV_n-bV_{n-1}$ (d) $V_{n+1}=aV_{n-1}-bV_n$

24. The value of 'c' for which $|\alpha^2-\beta^2|=\frac{7}{4}$, where α and β are the roots of $2x^2+7x+c=0$, is

(a) 4 (b) 0
(c) 6 (d) 2

25. For what value of λ the sum of the squares of the roots of $x^2+(2+\lambda)x-\frac{1}{2}(1+\lambda)=0$ is minimum

(a) 3/2 (b) 1
(c) 1/2 (d) 11/4

26. The product of all real roots of the equation $x^2-|x|-6=0$ is

(a) – 9 (b) 6
(c) 9 (d) 36

27. For the equation $3x^2+px+3=0, p>0$ if one of the root is square of the other, then p is equal

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

28. If $A_1, A_2; G_1, G_2$ and H_1, H_2 be $AM's, GM's$ and $HM's$ between two quantities, then the value of $\frac{G_1G_2}{H_1H_2}$ is

(a) $\frac{A_1+A_2}{H_1+H_2}$ (b) $\frac{A_1-A_2}{H_1+H_2}$
(c) $\frac{A_1+A_2}{H_1-H_2}$ (d) $\frac{A_1-A_2}{H_1-H_2}$

29. The harmonic mean of two numbers is 4 and the arithmetic and geometric means satisfy the relation $2A+G^2=27$, the numbers are

(a) $6, 3$ (b) 5, 4
(c) $5, -2.5$ (d) $-3, 1$

30. If the A.M. of two numbers is greater than G.M. of the numbers by 2 and the ratio of the numbers is $4:1$, then the numbers are

(a) 4, 1 (b) 12, 3
(c) 16, 4 (d) None of these

31. If $\frac{2z_1}{3z_2}$ is a purely imaginary number, then $\left|\frac{z_1-z_2}{z_1+z_2}\right|=$

(a) 3/2 (b) 1
(c) 2/3 (d) 4/9

32. If z_1 and z_2 are any two complex numbers then $|z_1+z_2|^2+|z_1-z_2|^2$ is equal to

(a) $2|z_1|^2|z_2|^2$ (b) $2|z_1|^2+2|z_2|^2$
(c) $|z_1|^2+|z_2|^2$ (d) $2|z_1||z_2|$

33. If z is a complex number such that $\frac{z-1}{z+1}$ is purely imaginary, then
(a) $|z|=0$ (b) $|z|=1$
(c) $|z|>1$ (d) $|z|<1$

34. If z is a complex number, then which of the following is not true
(a) $|z^2|=|z|^2$ (b) $|z^2|=|\bar{z}|^2$
(c) $z=\bar{z}$ (d) $\bar{z}^2=\bar{z}^2$

35. If the coefficient of 4th term in the expansion of $(a+b)^n$ is 56, then n is
(a) 12 (b) 10
(c) 8 (d) 6

36. The coefficient of x^{100} in the expansion of $\sum_{j=0}^{200}(1+x)^j$ is
(a) $\binom{200}{100}$ (b) $\binom{201}{102}$
(c) $\binom{200}{101}$ (d) $\binom{201}{100}$

37. For $2 \le r \le n, \binom{n}{r}+2\binom{n}{r-1}+\binom{n}{r-2}$ is equal to
(a) $\binom{n+1}{r-1}$ (b) $2\binom{n+1}{r+1}$
(c) $2\binom{n+2}{r}$ (d) $\binom{n+2}{r}$

38. The number of positive integral solutions of $abc=30$ is
(a) 30 (b) 27
(c) 8 (d) None of these

39. The points A (1, 3) and C (5, 1) are the opposite vertices of rectangle. The equation of line passing through other two vertices and of gradient 2, is
(a) $2x+y-8=0$ (b) $2x-y-4=0$
(c) $2x-y+4=0$ (d) $2x+y+7=0$

40. The intercept cut off from y–axis is twice that from x–axis by the line and line is passes through (1, 2) then its equation is
(a) $2x+y=4$ (b) $2x+y+4=0$
(c) $2x-y=4$ (d) $2x-y+4=0$

41. The extremities of a diagonal of a parallelogram are the points $(3,-4)$ and $(-6,5)$. If third vertex is $(-2,1)$, then fourth vertex is
(a) $(1,0)$ (b) $(-1,0)$
(c) $(1,1)$ (d) None of these

42. (0, –1) and (0, 3) are two opposite vertices of a square. The other two vertices are
(a) (0, 1), (0, –3) (b) (3, –1) (0, 0)
(c) (2, 1), (–2, 1) (d) (2, 2), (1, 1)

43. If $A(3,5), B(-5,-4), C(7,10)$ are the vertices of a parallelogram, taken in the order, then the co-ordinates of the fourth vertex are
(a) (10, 19) (b) (15, 10)
(c) (19, 10) (d) (19, 15)
(e) (15, 19)

44. If the point (a, a) are placed in between the lines $|x+y|=4$, then
(a) | a| = 2 (b) $|a|=3$
(c) | a| < 2 (d) | a| < 3

45. The equation of the locus of foot of perpendiculars drawn from the origin to the line passing through a fixed point (a, b), is
(a) $x^2+y^2-ax-by=0$ (b) $x^2+y^2+ax+by=0$
(c) $x^2+y^2-2ax-2by=0$ (d) None of these

46. The area bounded by the angle bisectors of the lines $x^2-y^2+2y=1$ and the line $x+y=3$, is
(a) 2 (b) 3
(c) 4 (d) 6

47. If $p=\frac{2\sin\theta}{1+\cos\theta+\sin\theta}$, and $q=\frac{\cos\theta}{1+\sin\theta}$, then
(a) $pq=1$ (b) $\frac{q}{p}=1$
(c) $q-p=1$ (d) $q+p=1$

48. If $\tan\theta+\sin\theta=m$ and $\tan\theta-\sin\theta=n$, then
(a) $m^2-n^2=4mn$ (b) $m^2+n^2=4mn$
(c) $m^2-n^2=m^2+n^2$ (d) $m^2-n^2=4\sqrt{mn}$

49. If $\tan\theta=\frac{a}{b}$, then $\frac{\sin\theta}{\cos^8\theta}+\frac{\cos\theta}{\sin^8\theta}=$
(a) $\pm\frac{(a^2+b^2)^4}{\sqrt{a^2+b^2}}\left(\frac{a}{b^8}+\frac{b}{a^8}\right)$ (b) $\pm\frac{(a^2+b^2)^4}{\sqrt{a^2+b^2}}\left(\frac{a}{b^8}-\frac{b}{a^8}\right)$
(c) $\pm\frac{(a^2-b^2)^4}{\sqrt{a^2+b^2}}\left(\frac{a}{b^8}+\frac{b}{a^8}\right)$ (d) $\pm\frac{(a^2-b^2)^4}{\sqrt{a^2-b^2}}\left(\frac{a}{b^8}-\frac{b}{a^8}\right)$

50. If $a\cos\theta+b\sin\theta=m$ and $a\sin\theta-b\cos\theta=n$, then $a^2+b^2=$
(a) $m+n$ (b) m^2-n^2
(c) m^2+n^2 (d) None of these

51. If $\sin 2\theta+\sin 2\phi=1/2$ and $\cos 2\theta+\cos 2\phi=3/2$, then $\cos^2(\theta-\phi)=$
(a) $3/8$ (b) $5/8$
(c) $3/4$ (d) $5/4$

52. $\cos 2(\theta+\phi) - 4\cos(\theta+\phi)\sin\theta\sin\phi + 2\sin^2\phi =$

(a) $\cos 2\theta$ (b) $\cos 3\theta$
(c) $\sin 2\theta$ (d) $\sin 3\theta$

53. Which of the following number(s) is/are rational

(a) $\sin 15°$ (b) $\cos 15°$
(c) $\sin 15° \cos 15°$ (d) $\sin 15° \cos 75°$

54. $\cos 15° =$

(a) $\sqrt{\frac{1+\cos 30°}{2}}$ (b) $\sqrt{\frac{1-\cos 30°}{2}}$
(c) $\pm\sqrt{\frac{1+\cos 30°}{2}}$ (d) $\pm\sqrt{\frac{1-\cos 30°}{2}}$

55. If $\sin A + \cos A = \sqrt{2}$, then $\cos^2 A =$

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

56. $\cos^{-1}\sqrt{1-x} + \sin^{-1}\sqrt{1-x} =$

(a) π (b) $\frac{\pi}{2}$
(c) 1 (d) 0

57. $\cos\left[2\cos^{-1}\frac{1}{5} + \sin^{-1}\frac{1}{5}\right] =$

(a) $\frac{2\sqrt{6}}{5}$ (b) $-\frac{2\sqrt{6}}{5}$
(c) $\frac{1}{5}$ (d) $-\frac{1}{5}$

58. If $2\cos^2 x + 3\sin x - 3 = 0,\ 0 \le x \le 180^o$, then x =

(a) $30^o, 90^o, 150^o$ (b) $60^o, 120^o, 180^o$
(c) $0^o, 30^o, 150^o$ (d) $45^o, 90^o, 135^o$

59. The equation $\sin x + \cos x = 2$ has

(a) One solution
(b) Two solutions
(c) Infinite number of solutions
(d) No solutions

60. In a triangle ABC, $a = 4, b = 3$, $\angle A = 60^o$. Then c is the root of the equation

(a) $c^2 - 3c - 7 = 0$ (b) $c^2 + 3c + 7 = 0$
(c) $c^2 - 3c + 7 = 0$ (d) $c^2 + 3c - 7 = 0$

61. If $a = 2, b = 3, c = 5$ in ΔABC, then C =

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{3}$
(c) $\frac{\pi}{2}$ (d) None of these

62. A ladder rests against a wall making an angle α with the horizontal. The foot of the ladder is pulled away from the wall through a distance x, so that it slides a distance y down the wall making an angle β with the horizontal. The correct relation is

(a) $x = y\tan\frac{\alpha+\beta}{2}$ (b) $y = x\tan\frac{\alpha+\beta}{2}$
(c) $x = y\tan(\alpha+\beta)$ (d) $y = x\tan(\alpha+\beta)$

63. The shadow of a tower is found to be 60 metre shorter when the sun's altitude changes from 30^o to 60^o. The height of the tower from the ground is approximately equal to

(a) 62m (b) 301m
(c) 101m (d) 52m

64. If the domain of function $f(x) = x^2 - 6x + 7$ is $(-\infty, \infty)$, then the range of function is

(a) $(-\infty, \infty)$ (b) $[-2, \infty)$
(c) $(-2, 3)$ (d) $(-\infty, -2)$

65. $\lim_{x\to\infty}\left[\frac{1^3 + 2^3 + 3^3 + ... + n^3}{n^4}\right] =$

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$
(c) $\frac{1}{4}$ (d) None of these

66. $\lim_{x\to 0}\frac{y^2}{x} =$ .... , where $y^2 = ax + bx^2 + cx^3$

(a) 0 (b) 1
(c) a (d) None of these

67. If $f(x) = \begin{cases} \frac{\sqrt{1+kx} - \sqrt{1-kx}}{x} & ,\text{for } -1 \le x < 0 \\ 2x^2 + 3x - 2 & ,\text{for } 0 \le x \le 1 \end{cases}$, is continuous at $x = 0$, then $k =$

(a) – 4 (b) – 3
(c) – 2 (d) – 1

68. The function $f(x) = \frac{1 - \sin x + \cos x}{1 + \sin x + \cos x}$ is not defined at $x = \pi$. The value of $f(\pi)$, so that $f(x)$ is continuous at $x = \pi$, is

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

69. Let f be differentiable for all x. If $f(1) = -2$ and $f'(x) \ge 2$ for $x \in [1,6]$, then

(a) $f(6) < 5$ (b) $f(6) = 5$
(c) $f(6) \ge 8$ (d) $f(6) < 8$

70. $f(x)=||x|-1|$ is not differentiable at

(a) 0 (b) $\pm1, 0$

(c) 1 (d) ±1

71. The radius of a circle which touches y-axis at (0,3) and cuts intercept of 8 units with x-axis, is

(a) 3 (b) 2

(c) 5 (d) 8

72. A point P moves in such a way that the ratio of its distance from two coplanar points is always a fixed number $(\neq 1)$. Then its locus is

(a) Straight line (b) Circle

(c) Parabola (d) A pair of straight lines

73. The point of intersection of the latus rectum and axis of the parabola $y^2+4x+2y-8=0$

(a) (5/4, –1) (b) (9/4, –1)

(c) (7/2, 5/2) (d) None of these

74. The point of contact of the tangent $18x-6y+1=0$ to the parabola $y^2=2x$ is

(a) $\left(\frac{-1}{18},\frac{-1}{3}\right)$ (b) $\left(\frac{-1}{18},\frac{1}{3}\right)$

(c) $\left(\frac{1}{18},\frac{-1}{3}\right)$ (d) $\left(\frac{1}{18},\frac{1}{3}\right)$

75. The position of the point (4, –3) with respect to the ellipse $2x^2+5y^2=20$ is

(a) Outside the ellipse (b) On the ellipse

(c) On the major axis (d) None of these

76. The equation of the tangent to the ellipse $x^2+16y^2=16$ making an angle of 60^o with x-axis is

(a) $\sqrt{3}x-y+7=0$ (b) $\sqrt{3}x-y-7=0$

(c) $\sqrt{3}x-y\pm7=0$ (d) None of these

77. What will be equation of that chord of hyperbola $25x^2-16y^2=400$, whose mid point is (5, 3)

(a) $115x-117y=17$ (b) $125x-48y=481$

(c) $127x+33y=341$ (d) $15x+121y=105$

78. The value of m, for which the line $y=mx+\frac{25\sqrt{3}}{3}$, is a normal to the conic $\frac{x^2}{16}-\frac{y^2}{9}=1$, is

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

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

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

(a) $\frac{e^x[1+(x+2)\log x]}{x^3}$ (b) $\frac{e^x[1-(x-2)\log x]}{x^4}$

(c) $\frac{e^x[1-(x-2)\log x]}{x^3}$ (d) $\frac{e^x[1+(x-2)\log x]}{x^3}$

80. If $y=\frac{e^{2x}\cos x}{x\sin x}$, then $\frac{dy}{dx}=$

(a) $\frac{e^{2x}[(2x-1)\cot x-x\operatorname{cosec}^2x]}{x^2}$

(b) $\frac{e^{2x}[(2x+1)\cot x-x\operatorname{cosec}^2x]}{x^2}$

(c) $\frac{e^{2x}[(2x-1)\cot x+x\operatorname{cosec}^2x]}{x^2}$

(d) None of these

81. $\frac{d}{dx}\{e^{-ax^2}\log(\sin x)\}=$

(a) $e^{-ax^2}(\cot x+2ax\log\sin x)$

(b) $e^{-ax^2}(\cot x+ax\log\sin x)$

(c) $e^{-ax^2}(\cot x-2ax\log\sin x)$

(d) None of these

82. The radius of the cylinder of maximum volume, which can be inscribed in a sphere of radius R is

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

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

83. The distance travelled s (in metre) by a particle in t seconds is given by, $s=t^3+2t^2+t$. The speed of the particle after 1 second will be

(a) 8 cm/sec (b) 6 cm/sec

(c) 2 cm/sec (d) None of these

84. If $y=4x-5$ is tangent to the curve $y^2=px^3+q$ at (2, 3), then

(a) $p=2, q=-7$ (b) $p=-2, q=7$

(c) $p=-2, q=-7$ (d) $p=2, q=7$

85. At what points of the curve $y=\frac{2}{3}x^3+\frac{1}{2}x^2$, tangent makes the equal angle with axis

(a) $\left(\frac{1}{2},\frac{5}{24}\right)$ and $\left(-1,-\frac{1}{6}\right)$ (b) $\left(\frac{1}{2},\frac{4}{9}\right)$ and $(-1,0)$

(c) $\left(\frac{1}{3},\frac{1}{7}\right)$ and $\left(-3,\frac{1}{2}\right)$ (d) $\left(\frac{1}{3},\frac{4}{47}\right)$ and $\left(-1,-\frac{1}{3}\right)$

86. $\frac{d}{dx}\left[\tan^{-1}\frac{\sqrt{1+x^2}+\sqrt{1-x^2}}{\sqrt{1+x^2}-\sqrt{1-x^2}}\right]=$

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

(c) $\frac{-1}{2\sqrt{1-x^4}}$ (d) $\frac{1}{2\sqrt{1-x^4}}$

87. If $\sqrt{(1-x^6)}+\sqrt{(1-y^6)}=a^3(x^3-y^3)$, then $\frac{dy}{dx}=$

(a) $\frac{x^2}{y^2}\sqrt{\frac{1-x^6}{1-y^6}}$ (b) $\frac{y^2}{x^2}\sqrt{\frac{1-y^6}{1-x^6}}$

(c) $\frac{x^2}{y^2}\sqrt{\frac{1-y^6}{1-x^6}}$ (d) None of these

88. If $y=\sec^{-1}\frac{2x}{1+x^2}+\sin^{-1}\frac{x-1}{x+1}$,then $\frac{dy}{dx}$ is equal to

(a) 1 (b) $\frac{x-1}{x+1}$

(c) Does not exist (d) None of these

89. $\int\sqrt{\frac{x}{a^3-x^3}}\,dx=$

(a) $\sin^{-1}\left(\frac{x}{a}\right)^{3/2}+c$ (b) $\frac{2}{3}\sin^{-1}\left(\frac{x}{a}\right)^{3/2}+c$

(c) $\frac{3}{2}\sin^{-1}\left(\frac{x}{a}\right)^{3/2}+c$ (d) $\frac{3}{2}\sin^{-1}\left(\frac{x}{a}\right)^{2/3}+c$

90. $\int\frac{1}{x\cos^2(1+\log x)}\,dx=$

(a) $\tan(1+\log x)+c$ (b) $\cot(1+\log x)+c$

(c) $-\tan(1+\log x)+c$ (d) $-\cot(1+\log x)+c$

91. $\int\frac{1}{x^2\sqrt{1+x^2}}\,dx=$

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

(c) $-\frac{\sqrt{1-x^2}}{x}+c$ (d) $-\frac{\sqrt{x^2-1}}{x}+c$

92. $\int\frac{1}{(x^2-1)\sqrt{x^2+1}}\,dx=$

(a) $\frac{1}{2\sqrt{2}}\log\left\{\frac{\sqrt{1+x^2}+x\sqrt{2}}{\sqrt{1+x^2}-x\sqrt{2}}\right\}+c$

(b) $\frac{1}{2\sqrt{2}}\log\left\{\frac{\sqrt{1+x^2}-\sqrt{2}}{\sqrt{1+x^2}+\sqrt{2}}\right\}+c$

(c) $\frac{1}{2\sqrt{2}}\log\left\{\frac{\sqrt{1+x^2}-x\sqrt{2}}{\sqrt{1+x^2}+x\sqrt{2}}\right\}+c$

(d) None of these

93. If $2f(x)-3f\left(\frac{1}{x}\right)=x$, then $\int_1^2 f(x)\,dx$ is equal to

(a) $\frac{3}{5}\ln 2$ (b) $\frac{-3}{5}(1+\ln 2)$

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

94. If $\int_a^b x^3dx=0$ and $\int_a^b x^2dx=\frac{2}{3}$, then the value of a and b will be respectively

(a) 1, 1 (b) $-1,-1$

(c) $1,-1$ (d) $-1,1$

95. The sine and cosine curves intersects infinitely many times giving bounded regions of equal areas. The area of one of such region is

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

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

96. The rate of increase of bacteria in a certain culture is proportional to the number present. If it double in 5 hours then in 25 hours, its number would be

(a) 8 times the original (b) 16 times the original

(c) 32 times the original (d) 64 times the original

97. The solution of $\frac{d^2y}{dx^2}=\cos x-\sin x$ is

(a) $y=-\cos x+\sin x+c_1x+c_2$

(b) $y=-\cos x-\sin x+c_1x+c_2$

(c) $y=\cos x-\sin x+c_1x^2+c_2x$

(d) $y=\cos x+\sin x+c_1x^2+c_2x$

98. The solution of the differential equation $x^4\frac{dy}{dx}+x^3y+\operatorname{cosec}(xy)=0$ is equal to

(a) $2\cos(xy)+x^{-2}=c$ (b) $2\cos(xy)+y^{-2}=c$

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

99. The solution of the equation $x^2\frac{d^2y}{dx^2}=\ln x$, when $x=1$, $y=0$ and $\frac{dy}{dx}=-1$ is

(a) $\frac{1}{2}(\ln x)^2+\ln x$ (b) $\frac{1}{2}(\ln x)^2-\ln x$

(c) $-\frac{1}{2}(\ln x)^2+\ln x$ (d) $-\frac{1}{2}(\ln x)^2-\ln x$

100. If $y\cos x+x\cos y=\pi$, then $y''(0)$ is

(a) 1 (b) π

(c) 0 (d) $-\pi$

101. The chances of throwing a total of 3 or 5 or 11 with two dice is

(a) $\frac{5}{36}$ (b) $\frac{1}{9}$

(c) $\frac{2}{9}$ (d) $\frac{19}{36}$

102. A six faced dice is so biased that it is twice as likely to show an even number as an odd number when thrown. It is thrown twice. The probability that the sum of two numbers thrown is even, is

(a) $\frac{1}{12}$ (b) $\frac{1}{6}$

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

103. The chance of India winning toss is 3/4. If it wins the toss, then its chance of victory is 4/5 otherwise it is only 1/2. Then chance of India's victory is

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

(c) $\frac{3}{40}$ (d) $\frac{29}{40}$

104. For two events A and B, if $P(A)=P\left(\frac{A}{B}\right)=\frac{1}{4}$ and $P\left(\frac{B}{A}\right)=\frac{1}{2}$, then

(a) A and B are independent (b) $P\left(\frac{A'}{B}\right)=\frac{3}{4}$

(c) $P\left(\frac{B'}{A'}\right)=\frac{1}{2}$ (d) All of the above

105. A biased die is tossed and the respective probabilities for various faces to turn up are given below

Face :	1	2	3	4	5	6
Probability :	0.1	0.24	0.19	0.18	0.15	0.14

If an even face has turned up, then the probability that it is face 2 or face 4, is

(a) 0.25 (b) 0.42

(c) 0.75 (d) 0.9

106. If $\mathbf{a}=\mathbf{i}+\mathbf{j}+\mathbf{k}$, $\mathbf{a}.\mathbf{b}=1$ and $\mathbf{a}\times\mathbf{b}=\mathbf{j}-\mathbf{k}$, then $\mathbf{b}=$

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

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

107. The position vectors of the vertices of a quadrilateral ABCD are $\mathbf{a},\mathbf{b},\mathbf{c}$ and $\mathbf{d}$ respectively. Area of the quadrilateral formed by joining the middle points of its sides is

(a) $\frac{1}{4}|\mathbf{a}\times\mathbf{b}+\mathbf{b}\times\mathbf{d}+\mathbf{d}\times\mathbf{a}|$

(b) $\frac{1}{4}|\mathbf{b}\times\mathbf{c}+\mathbf{c}\times\mathbf{d}+\mathbf{a}\times\mathbf{d}+\mathbf{b}\times\mathbf{a}|$

(c) $\frac{1}{4}|\mathbf{a}\times\mathbf{b}+\mathbf{b}\times\mathbf{c}+\mathbf{c}\times\mathbf{d}+\mathbf{d}\times\mathbf{a}|$

(d) $\frac{1}{4}|\mathbf{b}\times\mathbf{c}+\mathbf{c}\times\mathbf{d}+\mathbf{d}\times\mathbf{b}|$

108. The moment about the point $M(-2,4,-6)$ of the force represented in magnitude and position by $\overrightarrow{AB}$ where the points A and B have the co-ordinates $(1,2,-3)$ and $(3,-4,2)$ respectively, is

(a) $8\mathbf{i}-9\mathbf{j}-14\mathbf{k}$ (b) $2\mathbf{i}-6\mathbf{j}+5\mathbf{k}$

(c) $-3\mathbf{i}+2\mathbf{j}-3\mathbf{k}$ (d) $-5\mathbf{i}+8\mathbf{j}-8\mathbf{k}$

109. If the vectors $a\mathbf{i}+\mathbf{j}+\mathbf{k}$, $\mathbf{i}+b\mathbf{j}+\mathbf{k}$ and $\mathbf{i}+\mathbf{j}+c\mathbf{k}$ $(a\neq b\neq c\neq 1)$ are coplanar, then the value of $\frac{1}{1-a}+\frac{1}{1-b}+\frac{1}{1-c}=$

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

(c) 1/2 (d) 1

110. If $\alpha(\mathbf{a}\times\mathbf{b})+\beta(\mathbf{b}\times\mathbf{c})+\gamma(\mathbf{c}\times\mathbf{a})=\mathbf{0}$ and at least one of the numbers α,β and γ is non-zero, then the vectors **a, b** and **c** are

(a) Perpendicular (b) Parallel

(c) Coplanar (d) None of these

111. The volume of the tetrahedron, whose vertices are given by the vectors $-\mathbf{i}+\mathbf{j}+\mathbf{k}$, $\mathbf{i}-\mathbf{j}+\mathbf{k}$ and $\mathbf{i}+\mathbf{j}-\mathbf{k}$ with reference to the fourth vertex as origin, is

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

(c) $\frac{3}{5}$ cubic unit (d) None of these

112. Let $\mathbf{a}=\mathbf{i}-\mathbf{j}$, $\mathbf{b}=\mathbf{j}-\mathbf{k}$, $\mathbf{c}=\mathbf{k}-\mathbf{i}$. If $\hat{\mathbf{d}}$ is a unit vector such that $\mathbf{a}.\hat{\mathbf{d}}=0=[\mathbf{b}\ \mathbf{c}\ \hat{\mathbf{d}}]$, then $\hat{\mathbf{d}}$ is equal to

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

(c) $\pm\frac{\mathbf{i}+\mathbf{j}-2\mathbf{k}}{\sqrt{6}}$ (d) $\pm\mathbf{k}$

113. The value of 'a' so that the volume of parallelopiped formed by $\mathbf{i}+a\mathbf{j}+\mathbf{k}, \mathbf{j}+a\mathbf{k}$ and $a\mathbf{i}+\mathbf{k}$ becomes minimum is

(a) -3 (b) 3

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

114. If **b** and **c** are any two non-collinear unit vectors and **a** is any vector, then $(\mathbf{a}.\mathbf{b})\mathbf{b}+(\mathbf{a}.\mathbf{c})\mathbf{c}+\frac{\mathbf{a}.(\mathbf{b}\times\mathbf{c})}{|\mathbf{b}\times\mathbf{c}|}(\mathbf{b}\times\mathbf{c})=$

(a) **a** (b) **b**

(c) **c** (d) **0**

115. Two systems of rectangular axes have the same origin. If a plane cuts them at distance a, b, c and a', b', c' from the origin, then

(a) $\frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2}+\frac{1}{a'^2}+\frac{1}{b'^2}+\frac{1}{c'^2}=0$

(b) $\frac{1}{a^2}+\frac{1}{b^2}-\frac{1}{c^2}+\frac{1}{a'^2}+\frac{1}{b'^2}-\frac{1}{c'^2}=0$

(c) $\frac{1}{a^2}-\frac{1}{b^2}-\frac{1}{c^2}+\frac{1}{a'^2}-\frac{1}{b'^2}-\frac{1}{c'^2}=0$

(d) $\frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2}-\frac{1}{a'^2}-\frac{1}{b'^2}-\frac{1}{c'^2}=0$

116. If $4x+4y-kz=0$ is the equation of the plane through the origin that contains the line $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z}{4}$, then k =

(a) 1 (b) 3

(c) 5 (d) 7

117. The distance of the point (1, –2, 3) from the plane $x-y+z=5$ measured parallel to the line $\frac{x}{2}=\frac{y}{3}=\frac{z}{-6}$, is

(a) 1 (b) 6/7

(c) 7/6 (d) None of these

118. The distance of the point of intersection of the line $\frac{x-3}{1}=\frac{y-4}{2}=\frac{z-5}{2}$ and the plane $x+y+z=17$ from the point (3, 4, 5) is given by

(a) 3 (b) 3/2

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

119. The lines $\frac{x-a+d}{\alpha-\delta}=\frac{y-a}{\alpha}=\frac{z-a-d}{\alpha+\delta}$ and $\frac{x-b+c}{\beta-\gamma}=\frac{y-b}{\beta}=\frac{z-b-c}{\beta+\gamma}$ are coplanar and then equation to the plane in which they lie, is

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

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

120. The line $\frac{x-3}{2}=\frac{y-4}{3}=\frac{z-5}{4}$ lies in the plane $4x+4y-kz-d=0$. The values of k and d are

(a) 4, 8 (b) –5, – 3

(c) 5, 3 (d) – 4, – 8