1. A rough plane is inclined at an angle α to the horizon. A body is just to slide due to its own weight. The angle of friction would

(a) $\tan^{-1}\alpha$ (b) α

(c) $\tan\alpha$ (d) 2α

2. A particle is resting on a rough inclined plane with inclination α. The angle of friction is λ, the particle will be at rest if and only if,

(a) $\alpha > \lambda$ (b) $\alpha \geq \lambda$

(c) $\alpha \leq \lambda$ (d) $\alpha < \lambda$

3. The relation between the coefficient of friction (μ) and the angle of friction (λ) is given by

(a) $\mu = \cos\lambda$ (b) $\mu = \sin\lambda$

(c) $\mu = \tan\lambda$ (d) $\mu = \cot\lambda$

4. A rough inclined plane has its angle of inclination equal to 45^o and $\mu = 0.5$. The magnitude of the least force in *kg wt*, parallel to the plane required to move a body of 4*kg* up the plane is

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

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

5. A body of weight *W* rests on a rough plane, whose coefficient of friction is $\mu(=\tan\lambda)$ which is inclined at an angle α with the horizon. The least force required to pull the body up the plane is

(a) $2W\sin(\alpha+\lambda)$ (b) $W\sin(\alpha+\lambda)$

(c) $W\sin(\alpha-\lambda)$ (d) $2W\sin(\alpha-\lambda)$

6. A body consists of a solid cylinder with radius *a* and height *a* together with a solid hemisphere of radius *a* placed on the base of the cylinder. The centre of gravity of the complete body is

(a) Inside the cylinder

(b) Inside the hemisphere

(c) On the interface between the two

(d) Outside both

7. The centre of gravity *G* of three particles of equal mass placed at the three vertices of a right angled isosceles triangle whose hypotenuse is equal to 8 *cm* is on the median through *A* such that *AG* is

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

(c) $\frac{8}{3}$ (d) $\frac{10}{3}$

8. If $A = \begin{bmatrix} i & 0 \\ 0 & i/2 \end{bmatrix}$ $(i=\sqrt{-1})$, then $A^{-1} =$

(a) $\begin{bmatrix} i & 0 \\ 0 & i/2 \end{bmatrix}$ (b) $\begin{bmatrix} -i & 0 \\ 0 & -2i \end{bmatrix}$

(c) $\begin{bmatrix} i & 0 \\ 0 & 2i \end{bmatrix}$ (d) $\begin{bmatrix} 0 & i \\ 2i & 0 \end{bmatrix}$

9. If A is a non- singular matrix, then $A(adj\,A)$ =

(a) A (b) I

(c) $|A|I$ (d) $|A|^2 I$

10. The element of second row and third column in the inverse of $\begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 0 \\ -1 & 0 & 1 \end{bmatrix}$ is

(a) – 2 (b) – 1

(c) 1 (d) 2

11. $\begin{vmatrix} 1+i & 1-i & i \\ 1-i & i & 1+i \\ i & 1+i & 1-i \end{vmatrix} =$

(a) $-4-7i$ (b) $4+7i$

(c) $3+7i$ (d) $7+4i$

12. If $\begin{vmatrix} x+1 & 3 & 5 \\ 2 & x+2 & 5 \\ 2 & 3 & x+4 \end{vmatrix} = 0$, then x =

(a) 1, 9 (b) – 1, 9

(c) – 1, – 9 (d) 1, – 9

13. Let $S = \{0,1,5,4,7\}$. Then the total number of subsets of *S* is

(a) 64 (b) 32

(c) 40 (d) 20

14. The number of non-empty subsets of the set {1, 2, 3, 4} is

(a) 15 (b) 14

(c) 16 (d) 17

15. The smallest set *A* such that $A \cup \{1, 2\} = \{1, 2, 3, 5, 9\}$ is

(a) {2, 3, 5} (b) {3, 5, 9}

(c) {1, 2, 5, 9} (d) None of these

16. Let *R* = {(*a*, *a*)} be a relation on a set *A*. Then *R* is

(a) Symmetric

(b) Antisymmetric

(c) Symmetric and antisymmetric

(d) Neither symmetric nor anti-symmetric

17. The relation "is subset of" on the power set *P*(*A*) of a set *A* is

(a) Symmetric (b) Anti-symmetric

(c) Equivalency relation (d) None of these

18. The relation R defined on a set A is antisymmetric if $(a,b)\in R \Rightarrow (b,a)\in R$ for

(a) Every $(a, b) \in R$ (b) No $(a,b)\in R$

(c) No $(a,b), a\neq b, \in R$ (d) None of these

19. In the set A = {1, 2, 3, 4, 5}, a relation R is defined by

$R = \{(x, y) | x, y \in A$ and $x < y\}$. Then R is

(a) Reflexive (b) Symmetric

(c) Transitive (d) None of these

20. Let A be the non-void set of the children in a family. The relation 'x is a brother of y' on A is

(a) Reflexive (b) Symmetric

(c) Transitive (d) None of these

21. The graph of the function $y = f(x)$ is symmetrical about the line $x = 2$, then

(a) $f(x) = -f(-x)$ (b) $f(2+x) = f(2-x)$

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

22. If $f(x) = \frac{x}{x-1} = \frac{1}{y}$, then $f(y) =$

(a) x (b) $x+1$

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

23. $\lim_{x\to 0}\frac{e^{\sin x}-1}{x} =$

(a) 1 (b) e

(c) $1/e$ (d) None of these

24. $\lim_{x\to\infty}\sqrt{x}(\sqrt{x+5}-\sqrt{x}) =$

(a) 5 (b) 3

(c) 5/2 (d) 3/2

25. The value of m for which the function

$f(x) = \begin{cases} mx^2, x\le 1 \\ 2x, x>1 \end{cases}$ is differentiable at $x = 1$, is

(a) 0 (b) 1

(c) 2 (d) Does not exist

26. If $f(x) = \begin{cases} \frac{\sin 2x}{5x}, \text{when } x\neq 0 \\ k, \text{when } x = 0 \end{cases}$ is continuous at $x = 0$, then the value of k will be

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

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

27. If $f(x) = \begin{cases} 1+x^2, \text{ when } 0\le x\le 1 \\ 1-x, \text{ when } x>1 \end{cases}$, then

(a) $\lim_{x\to 1^+} f(x) \neq 0$

(b) $\lim_{x\to 1^-} f(x) \neq 2$

(c) $f(x)$ is discontinuous at $x = 1$

(d) None of these

28. The point(s) on the curve $y^3 + 3x^2 = 12y$ where the tangent is vertical (parallel to y-axis), is (are)

(a) $\left(\pm\frac{4}{\sqrt{3}}, -2\right)$ (b) $\left(\pm\frac{\sqrt{11}}{3}, 1\right)$

(c) $(0,0)$ (d) $\left(\pm\frac{4}{\sqrt{3}}, 2\right)$

29. Let $f(x) = \int_0^x \frac{\cos t}{t}dt, x>0$ then $f(x)$ has

(a) Maxima when $n = -2, -4, -6, ...$

(b) Maxima when $n = -1, -3, -5, ...$

(c) Minima when $n = 0, 2, 4, ...$

(d) Minima when $n = 1, 3, 5....$

30. If $f(x) = x^2 + 2bx + 2c^2$ and $g(x) = -x^2 - 2cx + b^2$ such that $min\ f(x) > max\ g(x)$, then the relation between b and c is

(a) No real value of b and c

(b) $0 < c < b\sqrt{2}$

(c) $|c| < |b|\sqrt{2}$

(d) $|c| > |b|\sqrt{2}$

31. The intercept on the line $y = x$ by the circle $x^2 + y^2 - 2x = 0$ is AB. Equation of the circle with AB as a diameter is

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

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

32. If θ is the angle subtended at $P(x_1, y_1)$ by the circle $S \equiv x^2 + y^2 + 2gx + 2fy + c = 0$, then

(a) $\cot\theta = \frac{\sqrt{S_1}}{\sqrt{g^2+f^2-c}}$ (b) $\cot\frac{\theta}{2} = \frac{\sqrt{S_1}}{\sqrt{g^2+f^2-c}}$

(c) $\tan\theta = \frac{2\sqrt{g^2+f^2-c}}{\sqrt{S_1}}$ (d) None of these

33. The equation of the parabola whose vertex and focus lies on the x-axis at distance a and a' from the origin, is

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

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

34. The focus of the parabola $y^2 = 4y - 4x$ is

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

35. The foci of $16x^2 + 25y^2 = 400$ are

(a) $(\pm 3, 0)$ (b) $(0, \pm 3)$
(c) $(3, -3)$ (d) $(-3, 3)$

36. Eccentricity of the ellipse $9x^2 + 25y^2 = 225$ is

(a) $\frac{3}{5}$ (b) $\frac{4}{5}$
(c) $\frac{9}{25}$ (d) $\frac{\sqrt{34}}{5}$

37. The equation of the directrices of the conic $x^2 + 2x - y^2 + 5 = 0$ are

(a) $x = \pm 1$ (b) $y = \pm 2$
(c) $y = \pm\sqrt{2}$ (d) $x = \pm\sqrt{3}$

38. Foci of the hyperbola $\frac{x^2}{16} - \frac{(y-2)^2}{9} = 1$ are

(a) (5, 2) (–5, 2) (b) (5, 2) (5, –2)
(c) (5, 2) (–5, –2) (d) None of these

39. $\int \frac{x^2 + x - 6}{(x-2)(x-1)} dx =$

(a) $x + 2\log(x-1) + c$ (b) $2x + 2\log(x-1) + c$
(c) $x + 4\log(1-x) + c$ (d) $x + 4\log(x-1) + c$

40. $\int \frac{dx}{4\cos^3 2x - 3\cos 2x} =$

(a) $\frac{1}{3}\log[\sec 6x + \tan 6x] + c$ (b) $\frac{1}{6}\log[\sec 6x + \tan 6x] + c$
(c) $\log[\sec 6x + \tan 6x] + c$ (d) None of these

41. If $\cos x = \frac{1}{\sqrt{1+t^2}}$ and $\sin y = \frac{t}{\sqrt{1+t^2}}$, then $\frac{dy}{dx} =$

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

42. If $x = a(\cos\theta + \theta\sin\theta)$, $y = a(\sin\theta - \theta\cos\theta)$, then $\frac{dy}{dx} =$

(a) $\cos\theta$ (b) $\tan\theta$
(c) $\sec\theta$ (d) $\text{cosec}\,\theta$

43. If $x = a\cos^4\theta, y = a\sin^4\theta$, then $\frac{dy}{dx}$, at $\theta = \frac{3\pi}{4}$, is

(a) –1 (b) 1
(c) $-a^2$ (d) a^2

44. If $x = \sin^{-1}(3t - 4t^3)$ and $y = \cos^{-1}\sqrt{(1-t^2)}$, then $\frac{dy}{dx}$ is equal to

(a) 1/2 (b) 2/5
(c) 3/2 (d) 1/3

45. If $x = a\left(t - \frac{1}{t}\right), y = a\left(t + \frac{1}{t}\right)$ then $\frac{dy}{dx} =$

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

46. If $x = \sin t \cos 2t$ and $y = \cos t \sin 2t$, then at $t = \frac{\pi}{4}$, the value of $\frac{dy}{dx}$ is equal to

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

47. If $\ln(x+y) = 2xy$, then $y'(0) =$

(a) 1 (b) –1
(c) 2 (d) 0

48. If a, b, c, d are positive real numbers such that $a+b+c+d = 2$, then $M = (a+b)(c+d)$ satisfies the relation

(a) $0 < M \le 1$ (b) $1 \le M \le 2$
(c) $2 \le M \le 3$ (d) $3 \le M \le 4$

49. Suppose a, b, c are in A.P. and a^2, b^2, c^2 are in G.P. If $a < b < c$ and $a + b + c = \frac{3}{2}$, then the value of a is

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

50. n^{th} term of the series $1 + \frac{4}{5} + \frac{7}{5^2} + \frac{10}{5^3} + \ldots\ldots..$ will be

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

51. Suppose z_1, z_2, z_3 are the vertices of an equilateral triangle inscribed in the circle $|z| = 2$. If $z_1 = 1 + i\sqrt{3}$, then values of z_3 and z_2 are respectively

(a) $-2, 1 - i\sqrt{3}$ (b) $2, 1 + i\sqrt{3}$
(c) $1 + i\sqrt{3}, -2$ (d) None of these

52. If the complex number z_1, z_2 the origin form an equilateral triangle then $z_1^2 + z_2^2 =$

(a) $z_1 z_2$ (b) $z_1 \overline{z_2}$
(c) $\overline{z_2} z_1$ (d) $|z_1|^2 = |z_2|^2$

53. If at least one value of the complex number $z = x + iy$ satisfy the condition $|z + \sqrt{2}| = a^2 - 3a + 2$ and the inequality $|z + i\sqrt{2}| < a^2$, then

(a) $a > 2$ (b) $a = 2$
(c) $a < 2$ (d) None of these

54. If z, iz and $z + iz$ are the vertices of a triangle whose area is 2 units, then the value of $|z|$ is

(a) – 2 (b) 2
(c) 4 (d) 8

55. The number of straight lines that are equally inclined to the three dimensional co-ordinate axes, is

(a) 2 (b) 4
(c) 6 (d) 8

56. The equation of the plane passing through the line $\frac{x-1}{5} = \frac{y+2}{6} = \frac{z-3}{4}$ and the point (4, 3, 7) is

(a) $4x + 8y + 7z = 41$ (b) $4x - 8y + 7z = 41$
(c) $4x - 8y - 7z = 41$ (d) $4x - 8y + 7z = 39$

57. A plane which passes through the point (3, 2, 0) and the line $\frac{x-3}{1} = \frac{y-6}{5} = \frac{z-4}{4}$ is

(a) $x - y + z = 1$ (b) $x + y + z = 5$
(c) $x + 2y - z = 0$ (d) $2x - y + z = 5$

58. The ratio in which the line joining the points (2, 4, 5) and (3, 5, –4) is divided by the yz-plane is

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

59. The angle between the line $\frac{x}{2} = \frac{y}{3} = \frac{z}{4}$ and the plane $3x + 2y - 3z = 4$ is

(a) 45° (b) 0°
(c) $\cos^{-1}\left(\frac{24}{\sqrt{29}\sqrt{22}}\right)$ (d) 90°

60. The line joining the points (3, 5, –7) and (–2, 1, 8) meets the yz-plane at point

(a) $\left(0, \frac{13}{5}, 2\right)$ (b) $\left(2, 0, \frac{13}{5}\right)$
(c) $\left(0, 2, \frac{13}{5}\right)$ (d) (2, 2, 0)

61. The circular wire of diameter 10cm is cut and placed along the circumference of a circle of diameter 1 metre. The angle subtended by the wire at the centre of the circle is equal to

(a) $\frac{\pi}{4}$ *radian* (b) $\frac{\pi}{3}$ *radian*
(c) $\frac{\pi}{5}$ *radian* (d) $\frac{\pi}{10}$ *radian*

62. The value of $\sin^2 5^o + \sin^2 10^o + \sin^2 15^o + ... + \sin^2 85^o + \sin^2 90^o$ is equal to

(a) 7 (b) 8
(c) 9 (d) $9\frac{1}{2}$

63. If $\frac{3\pi}{4} < \alpha < \pi$, then $\sqrt{\operatorname{cosec}^2\alpha + 2\cot\alpha}$ is equal to

(a) $1 + \cot\alpha$ (b) $1 - \cot\alpha$
(c) $-1 - \cot\alpha$ (d) $-1 + \cot\alpha$

64. If $a\cos^3\alpha + 3a\cos\alpha\sin^2\alpha = m$ and $a\sin^3\alpha + 3a\cos^2\alpha\sin\alpha = n$, then $(m+n)^{2/3} + (m-n)^{2/3}$ is equal to

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

65. If $\cos(\theta - \alpha) = a$, $\sin(\theta - \beta) = b$, then $\cos^2(\alpha - \beta) + 2ab\sin(\alpha - \beta)$ is equal to

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

66. If $\sin A = n\sin B$, then $\frac{n-1}{n+1}\tan\frac{A+B}{2} =$

(a) $\sin\frac{A-B}{2}$ (b) $\tan\frac{A-B}{2}$
(c) $\cot\frac{A-B}{2}$ (d) None of these

67. If $x + \frac{1}{x} = 2\cos\theta$, then $x^3 + \frac{1}{x^3} =$

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

68. If $\sin x + \operatorname{cosec} x = 2$, then $\sin^n x + \operatorname{cosec}^n x$ is equal to

(a) 2 (b) 2^n
(c) 2^{n-1} (d) 2^{n-2}

69. If $\tan\theta = \frac{\sin\alpha - \cos\alpha}{\sin\alpha + \cos\alpha}$, then $\sin\alpha + \cos\alpha$ and $\sin\alpha - \cos\alpha$ must be equal to

(a) $\sqrt{2}\cos\theta, \sqrt{2}\sin\theta$ (b) $\sqrt{2}\sin\theta, \sqrt{2}\cos\theta$
(c) $\sqrt{2}\sin\theta, \sqrt{2}\sin\theta$ (d) $\sqrt{2}\cos\theta, \sqrt{2}\cos\theta$

70. If $\cos^6\alpha + \sin^6\alpha + K\sin^2 2\alpha = 1$, then K =

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

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

71. The number of real values of x for which the equality $\left|3x^2 + 12x + 6\right| = 5x + 16$ holds good is

(a) 4 (b) 3

(c) 2 (d) 1

72. If x is real and satisfies $x + 2 > \sqrt{x+4}$, then

(a) $x < -2$ (b) $x > 0$

(c) $-3 < x < 0$ (d) $-3 < x < 4$

73. The complete solution of the inequation $x^2 - 4x < 12$ is

(a) $x < -2$ or $x > 6$ (b) $-6 < x < 2$

(c) $2 < x < 6$ (d) $-2 < x < 6$

74. The number of roots of the equation $\log(-2x) = 2\log(x+1)$ are

(a) 3 (b) 2

(c) 1 (d) None of these

75. The set of all real numbers x for which $x^2 - |x+2| + x > 0$, is

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

(c) $(-\infty, -1) \cup (1, \infty)$ (d) $(\sqrt{2}, \infty)$

76. If $x^2 + 2ax + 10 - 3a > 0$ for all $x \in R$, then

(a) $-5 < a < 2$ (b) $a < -5$

(c) $a > 5$ (d) $2 < a < 5$

77. The roots of the equation $x^4 - 4x^3 + 6x^2 - 4x + 1 = 0$ are

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

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

78. If the roots of the equation $8x^3 - 14x^2 + 7x - 1 = 0$ are in G.P., then the roots are

(a) $1, \frac{1}{2}, \frac{1}{4}$ (b) 2, 4, 8

(c) 3, 6, 12 (d) None of these

79. If the sum of the two roots of the equation $4x^3 + 16x^2 - 9x - 36 = 0$ is zero, then the roots are

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

(c) $-3, \frac{3}{2}, -\frac{3}{2}$ (d) $-4, \frac{3}{2}, -\frac{3}{2}$

80. $\frac{d^3y}{dx^3} + 2\left[1 + \frac{d^2y}{dx^2}\right] = 1$ has degree and order as

(a) 1, 3 (b) 2, 3

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

81. The differential equation whose solution is $y = c_1 \cos ax + c_2 \sin ax$ is

(Where c_1, c_2 are arbitrary constants)

(a) $\frac{d^2y}{dx^2} + y^2 = 0$ (b) $\frac{d^2y}{dx^2} + a^2y = 0$

(c) $\frac{d^2y}{dx^2} + ay^2 = 0$ (d) $\frac{d^2y}{dx^2} - a^2y = 0$

82. The differential equation for the line $y = mx + c$ is (where c is arbitrary constant)

(a) $\frac{dy}{dx} = m$ (b) $\frac{dy}{dx} + m = 0$

(c) $\frac{dy}{dx} = 0$ (d) None of these

83. The general solution of $x^2\frac{dy}{dx} = 2$ is

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

(c) $y = 2cx$ (d) $y = c - \frac{3}{x^2}$

84. The solution of $\frac{dy}{dx} = x\log x$ is

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

(c) $y = \frac{1}{2}x^2 + \frac{1}{2}x^2\log x + c$ (d) None of these

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

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

(c) $\log(1+y) = \log(1+x) + c$ (d) None of these

86. The greatest and the least value of $(\sin^{-1}x)^3 + (\cos^{-1}x)^3$ are

(a) $-\frac{\pi}{2}, \frac{\pi}{2}$ (b) $-\frac{\pi^3}{8}, \frac{\pi^3}{8}$

(c) $\frac{7\pi^3}{8}, \frac{\pi^3}{32}$ (d) None of these

87. If $a < \frac{1}{32}$, then the number of solution of $(\sin^{-1}x)^3 + (\cos^{-1}x)^3 = a\pi^3$ is

(a) 0 (b) 1

(c) 2 (d) Infinite

88. If $k \le \sin^{-1} x + \cos^{-1} x + \tan^{-1} x \le K$, then

(a) $k = 0, K = \pi$ (b) $k = 0, K = \frac{\pi}{2}$

(c) $k = \frac{\pi}{2}, K = \pi$ (d) None of these

89. The angle of elevation of the top of a pillar at any point A on the ground is 15°. On walking 40 *metres* towards the pillar, the angle become 30°. The height of the pillar is

(a) 40 *metres* (b) 20 *metres*

(c) $20\sqrt{3}$*metres* (d) $\frac{40}{3}\sqrt{3}$*metres*

90. The top of a hill observed from the top and bottom of a building of height h is at the angle of elevation p and q respectively. The height of the hills is

(a) $\frac{h \cot q}{\cot q - \cot p}$ (b) $\frac{h \cot p}{\cot p - \cot q}$

(c) $\frac{h \tan p}{\tan p - \tan q}$ (d) None of these

91. In the expansion of $(5^{1/2} + 7^{1/8})^{1024}$, the number of integral terms is

(a) 128 (b) 129

(c) 130 (d) 131

92. The number of terms which are free from radical signs in the expansion of $(y^{1/5} + x^{1/10})^{55}$ is

(a) 5 (b) 6

(c) 7 (d) None of these

93. In a certain test there are n questions. In the test 2^{n-i} students gave wrong answers to at least i questions, where $i = 1, 2, ...n$. If the total number of wrong answers given is 2047, then n is equal to

(a) 10 (b) 11

(c) 12 (d) 13

94. The number of times the digit 3 will be written when listing the integers from 1 to 1000 is

(a) 269 (b) 300

(c) 271 (d) 302

95. The binomial distribution for which mean = 6 and variance = 2, is

(a) $\left(\frac{2}{3} + \frac{1}{3}\right)^6$ (b) $\left(\frac{2}{3} + \frac{1}{3}\right)^9$

(c) $\left(\frac{1}{3} + \frac{2}{3}\right)^6$ (d) $\left(\frac{1}{3} + \frac{2}{3}\right)^9$

96. Six boys and six girls sit in a row. What is the probability that the boys and girls sit alternatively

(a) $\frac{1}{462}$ (b) $\frac{1}{924}$

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

97. Cards are drawn one by one at random from a well shuffled full pack of 52 cards until two aces are obtained for the first time. If N is the number of cards required to be drawn, then $P_r\{N = n\}$, where $2 \le n \le 50$, is

(a) $\frac{(n-1)(52-n)(51-n)}{50 \times 49 \times 17 \times 13}$ (b) $\frac{2(n-1)(52-n)(51-n)}{50 \times 49 \times 17 \times 13}$

(c) $\frac{3(n-1)(52-n)(51-n)}{50 \times 49 \times 17 \times 13}$ (d) $\frac{4(n-1)(52-n)(51-n)}{50 \times 49 \times 17 \times 13}$

98. Let X be a set containing n elements. If two subsets A and B of X are picked at random, the probability that A and B have the same number of elements, is

(a) $\frac{^{2n}C_n}{2^{2n}}$ (b) $\frac{1}{^{2n}C_n}$

(c) $\frac{1.3.5......(2n-1)}{2^n}$ (d) $\frac{3^n}{4^n}$

99. If three dice are thrown simultaneously, then the probability of getting a score of 7 is

(a) $\frac{5}{216}$ (b) $\frac{1}{6}$

(c) $\frac{5}{72}$ (d) None of these

100. Seven white balls and three black balls are randomly placed in a row. The probability that no two black balls are placed adjacently equals

(a) $\frac{1}{2}$ (b) $\frac{7}{15}$

(c) $\frac{2}{15}$ (d) $\frac{1}{3}$

101. $\mathbf{a} \times (\mathbf{b} \times \mathbf{c})$ is equal to

(a) $(\mathbf{a}.\mathbf{c})\mathbf{b} - (\mathbf{a}.\mathbf{a})\mathbf{b}$ (b) $(\mathbf{a}.\mathbf{c})\mathbf{a} - (\mathbf{b}.\mathbf{c})\mathbf{a}$

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

102. If $\mathbf{a} \times \mathbf{b} = \mathbf{c}$, $\mathbf{b} \times \mathbf{c} = \mathbf{a}$ and a, b, c be moduli of the vectors **a**, **b**, **c** respectively, then

(a) $a = 1, b = c$ (b) $c = 1, a = 1$

(c) $b = 2, c = 2a$ (d) $b = 1, c = a$

103. If $\mathbf{a} = 3\mathbf{i} - \mathbf{j} + 2\mathbf{k}$, $\mathbf{b} = 2\mathbf{i} + \mathbf{j} - \mathbf{k}$ and $\mathbf{c} = \mathbf{i} - 2\mathbf{j} + 2\mathbf{k}$, then $(\mathbf{a} \times \mathbf{b}) \times \mathbf{c}$ is equal to

(a) $24\mathbf{i} + 7\mathbf{j} - 5\mathbf{k}$ (b) $7\mathbf{i} - 24\mathbf{j} + 5\mathbf{k}$

(c) $12\mathbf{i} + 3\mathbf{j} - 5\mathbf{k}$ (d) $\mathbf{i} + \mathbf{j} - 7\mathbf{k}$

104. $\mathbf{i} \times (\mathbf{j} \times \mathbf{k}) =$

(a) 1 (b) 0

(c) – 1 (d) None of these

105. If three unit vectors **a**, **b**, **c** are such that $\mathbf{a}\times(\mathbf{b}\times\mathbf{c})=\frac{\mathbf{b}}{2}$, then the vector **a** makes with **b** and **c** respectively the angles

(a) $40^o, 80^o$ (b) $45^o, 45^o$

(c) $30^o, 60^o$ (d) $90^o, 60^o$

106. The locus of a point equidistant from two given points **a** and **b** is given by

(a) $[\mathbf{r}-\frac{1}{2}(\mathbf{a}+\mathbf{b})].(\mathbf{a}-\mathbf{b})=0$

(b) $[\mathbf{r}-\frac{1}{2}(\mathbf{a}-\mathbf{b})].(\mathbf{a}+\mathbf{b})=0$

(c) $[\mathbf{r}-\frac{1}{2}(\mathbf{a}+\mathbf{b})].(\mathbf{a}+\mathbf{b})=0$

(d) $[\mathbf{r}-\frac{1}{2}(\mathbf{a}-\mathbf{b})].(\mathbf{a}-\mathbf{b})=0$

107. If the non-zero vectors **a** and **b** are perpendicular to each other, then the solution of the equation $\mathbf{r}\times\mathbf{a}=\mathbf{b}$ is given by

(a) $\mathbf{r}=x\mathbf{a}+\frac{1}{\mathbf{a}.\mathbf{a}}(\mathbf{a}\times\mathbf{b})$ (b) $\mathbf{r}=x\mathbf{b}-\frac{1}{\mathbf{b}.\mathbf{b}}(\mathbf{a}\times\mathbf{b})$

(c) $\mathbf{r}=x\mathbf{a}\times\mathbf{b}$ (d) $\mathbf{r}=x\mathbf{b}\times\mathbf{a}$

108. If **r** be position vector of any point on a sphere and **a**, **b** are respectively position vectors of the extremities of a diameter, then

(a) $\mathbf{r}.(\mathbf{a}-\mathbf{b})=0$ (b) $\mathbf{r}.(\mathbf{r}-\mathbf{a})=0$

(c) $(\mathbf{r}+\mathbf{a}).(\mathbf{r}+\mathbf{b})=0$ (d) $(\mathbf{r}-\mathbf{a}).(\mathbf{r}-\mathbf{b})=0$

109. Angle between the line $\mathbf{r}=(\mathbf{i}+2\mathbf{j}-\mathbf{k})+\lambda(\mathbf{i}-\mathbf{j}+\mathbf{k})$ and the normal to the plane $\mathbf{r}.(2\mathbf{i}-\mathbf{j}+\mathbf{k})=4$ is

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

(c) $\tan^{-1}\left(\frac{2\sqrt{2}}{3}\right)$ (d) $\cot^{-1}\left(\frac{2\sqrt{2}}{3}\right)$

110. $\int_0^{\pi}\frac{xdx}{1+\sin x}$ is equal to

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

(c) π (d) None of these

111. The value of $\int_{-2}^{3}|1-x^2|\,dx$ is

(a) $\frac{1}{3}$ (b) $\frac{14}{3}$

(c) $\frac{7}{3}$ (d) $\frac{28}{3}$

112. If $f(x)=|x-1|$, then $\int_0^2 f(x)dx$ is

(a) 1 (b) 0

(c) 2 (d) –2

113. The lines represented by the equation $ax^2(b-c)-xy(ab-bc)+cy^2(a-b)=0$ are

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

(b) $x+y=0$, $x-y=0$

(c) $a(b-c)x-c(a-b)y=0$, $x-y=0$

(d) None of these

114. If the equation $ax^2+2hxy+by^2=0$ represents two lines $y=m_1x$ and $y=m_2x$, then

(a) $m_1+m_2=\frac{-2h}{b}$ and $m_1m_2=\frac{a}{b}$

(b) $m_1+m_2=\frac{2h}{b}$ and $m_1m_2=\frac{-a}{b}$

(c) $m_1+m_2=\frac{2h}{b}$ and $m_1m_2=\frac{a}{b}$

(d) $m_1+m_2=\frac{2h}{b}$ *and* $m_1m_2=-ab$

115. The nature of straight lines represented by the equation $4x^2+12xy+9y^2=0$ is

(a) Real and coincident

(b) Real and different

(c) Imaginary and different

(d) None of the above

116. The three points (–2,2), (8,–2) and (–4, –3) are the vertices of

(a) An isosceles triangle (b) An equilateral triangle

(c) A right angled triangle (d) None of these

117. The points $\left(\frac{a}{\sqrt{3}},a\right),\left(\frac{2a}{\sqrt{3}},2a\right),\left(\frac{a}{\sqrt{3}},3a\right)$ are the vertices of

(a) An equilateral triangle (b) An isosceles triangle

(c) A right angled triangle (d) None of these

118. The area enclosed within the curve $|x|+|y|=1$ is

(a) $\sqrt{2}$ (b) 1

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

119. The area of triangle formed by the lines $x=0, y=0$ and $\frac{x}{a}+\frac{y}{b}=1$, is

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

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

120. A line L passes through the points (1, 1) and (2, 0) and another line L' passes through $\left(\frac{1}{2},0\right)$ and perpendicular to L. Then the area of the triangle formed by the lines L, L' and y- axis, is

(a) 15/8 (b) 25/4

(c) 25/8 (d) 25/16