1. If $\tan\theta + \sec\theta = e^x$, then $\cos\theta$ is equal to :

(1) $\dfrac{2}{e^x + e^{-x}}$

(2) $\dfrac{e^x - e^{-x}}{2}$

(3) $\dfrac{e^x + e^{-x}}{2}$

(4) $\dfrac{2}{e^{-x} - e^x}$

2. If $n(A) = m$ and $n(B) = n$, then the total number of non-empty relations that can be defined from A to B are :

(1) $m^n - 1$

(2) $2^{mn} - 1$

(3) $n^m - 1$

(4) 2^{mn}

3. If functions $f : R \to R$ and $g : R \to R$ are defined as $f(x) = 2x^2 - 5$ and $g(x) = \dfrac{x}{x^2 - 1}$, then gof is :

(1) $\dfrac{2x^2 - 5}{4x^4 + 20x^2 + 24}$

(2) $-\left(\dfrac{5x^4 + 12x^2 + 5}{(x^2 - 1)^2}\right)$

(3) $\dfrac{2x^2 - 5}{4x^4 - 20x^2 + 24}$

(4) $\dfrac{-5x^4 + 12x^2 - 5}{(x^2 - 1)^2}$

4. Relation B in the set of real numbers R is defined as :

$B = \{(a, b) : a \leq b^2, a \in R, b \in R\}$.

Then the relation is :

(1) Reflexive and transitive but not symmetric

(2) Reflexive but not symmetric and not transitive

(3) Symmetric but not reflexive and not transitive

(4) Not reflexive, not symmetric and not transitive

5. Let A = {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}. It's Subsets B, C and D are defined as :

B = { x : x is an odd integer }

C = { x : x is an even integer }

D = { x : $x \leq 5$ }

Then the set $B \cap (D \cup C)$ is :

(1) {1, 3, 5}

(2) {2, 4, 6, 8}

(3) {1, 2, 3, 4, 6}

(4) {0, 1, 2, 4, 5, 6}

6. In the power set of set $\{-1, 0, 1\}$, the number of sets will be :

(1) 4

(2) 7

(3) 8

(4) 9

7. In a class of 25 students, 12 have taken Mathematics, 8 have taken Mathematics but not Biology. If each student has taken at least one subject, then the number of students who have taken Biology but not Mathematics are :

(1) 12

(2) 13

(3) 4

(4) 17

8. From the top of a hill, the angles of the depression of two consecutive km stones due east are found to be 30° and 45°. The height of the hill (in km) is :

(1) $\frac{1}{2}\left(\sqrt{3} - 1\right)$

(2) $\left(\sqrt{3} - 1\right)$

(3) $\left(\sqrt{3} + 1\right)$

(4) $\frac{1}{2}\left(\sqrt{3} + 1\right)$

9. If the angles of a triangle are in the ratio 3 : 4 : 5, then the value of greatest angle in radians is :

(1) $\frac{5\pi}{12}$

(2) $\frac{\pi}{2}$

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

(4) $\frac{\pi}{3}$

10. Solution of the trigonometric equation $\cos x = -\frac{\sqrt{3}}{2}$ is :

(1) $\frac{5\pi}{6}$

(2) $2n\pi \pm \frac{5\pi}{6}$

(3) $2n\pi + \frac{5\pi}{6}$

(4) $-\frac{\pi}{6}$

11. The number of real solutions of the equation $\sqrt{1+\cos 2x} = \sqrt{2}\cos^{-1}(\cos x)$ in $\left[\frac{\pi}{2}, \pi\right]$ is :

(1) 0

(2) 1

(3) 2

(4) Infinite

12. Solution of trigonometric equation $2\tan^{-1}(\sin x) = \tan^{-1}(2\sec x)$, is :

(1) 0

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

(3) $\frac{\pi}{3}$

(4) $\frac{\pi}{6}$

13. The principal value of $\sin^{-1}\left(-\frac{1}{2}\right) + \cos^{-1}\left(-\frac{1}{2}\right)$ is :

(1) $\frac{\pi}{2}$

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

(3) $\frac{\pi}{6}$

(4) 0

14. If $|a+ib|=|c+id|$, then :

(1) $a^2+c^2=0$

(2) $b^2+c^2=0$

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

(4) $b^2+d^2=0$

15. Which of the following is correct for any two complex numbers z_1 and z_2 ?

(1) $|z_1z_2| = |z_1||z_2|$

(2) $\arg (z_1z_2)=(\arg z_1)\cdot(\arg z_2)$

(3) $|z_1+z_2|=|z_1|+|z_2|$

(4) $|z_1+z_2|\geq|z_1|-|z_2|$

16. The complex number $\dfrac{2(5+\sqrt{3}\,i)}{1-\sqrt{3}\,i}$ can be expressed in the form $a+ib$ as :

(1) $1-\sqrt{3}\,i$

(2) $1+\sqrt{3}\,i$

(3) $1+3\sqrt{3}\,i$

(4) $1-3\sqrt{3}\,i$

17. If the value of $\begin{vmatrix} x & 2 & x \\ x^2 & x & 6 \\ x & x & 6 \end{vmatrix}=ax^4+bx^3+cx^2+dx+e$, then the value of $a+b+c+d$ is :

(1) 2

(2) 24

(3) 26

(4) 0

18. The system of linear equations

$x+y+z=2$

$2x+y-z=3$

$3x+2y+kz=4$

will have unique solution if :

(1) $k\neq 0$

(2) $k=0$

(3) $-1<k<1$

(4) $-2<k<2$

19. If $A=\begin{bmatrix}1 & 2\\ 3 & -5\end{bmatrix}$ and $B=\begin{bmatrix}1 & 0\\ 0 & 2\end{bmatrix}$ are two matrices and X is a matrix such that $A=BX$, then matrix X is :

(1) $-\dfrac{1}{11}\begin{bmatrix}-5 & -4\\ -3 & 2\end{bmatrix}$

(2) $\dfrac{1}{2}\begin{bmatrix}2 & 4\\ 3 & -5\end{bmatrix}$

(3) $\begin{bmatrix}2 & 4\\ 3 & -5\end{bmatrix}$

(4) $\dfrac{1}{2}\begin{bmatrix}1 & 4\\ 3 & -10\end{bmatrix}$

20. If $A=\begin{bmatrix}a & 0 & 0\\ 0 & a & 0\\ 0 & 0 & a\end{bmatrix}$, the value of $|\text{Adj } A|$ is :

(1) a^{27}
(2) a^9
(3) a^6
(4) a^3

21. Which of the following equations has no real roots ?

(1) $x^2 - 4x + 3\sqrt{2} = 0$

(2) $x^2 - 4x - 3\sqrt{2} = 0$

(3) $x^2 + 4x - 3\sqrt{2} = 0$

(4) $3x^2 + 4\sqrt{3}\,x + 4 = 0$

22. The difference of squares of the length and breadth of a rectangle is 180. The square of the length is 8 times the breadth. The measure of the breadth is :

(1) 14
(2) 18
(3) 10
(4) 12

23. The value of k for which the quadratic equation $kx^2+8kx+32=0$ has equal roots is :

(1) 1
(2) 2
(3) 4
(4) 8

24. Equation of the line passing through (1, 2) and parallel to the line $y=4x-1$ is :

(1) $y-4x=2$

(2) $4x+y=-2$

(3) $4x-y=2$

(4) $4x+y=2$

25. The point (3, 4) undergoes the following two successive transformations.

(i) Reflection along the line $y=x$

(ii) Translation through a distance of 2 units along the negative x-axis

The final position of the point is at :

(1) (3, 2)

(2) (2, 3)

(3) (6, 3)

(4) $\left(\frac{7}{2}, \frac{7}{2}\right)$

26. The vertex of a parabola is at $(-3, 0)$ and the directrix is the line $x+5=0$, then its equation is :

(1) $y^2=8(x+3)$

(2) $y^2=-8(x+3)$

(3) $x^2=8(y+3)$

(4) $y^2=8(x+5)$

27. If $-2x+15 < -13$, then :

(1) $x \in (-\infty, 14]$

(2) $x \in (14, \infty)$

(3) $x \in [14, \infty)$

(4) $x \in [-14, 14)$

28. The largest side of a triangle is three times the shortest side and third side is 4 cm longer than the shortest side. If the perimeter of the triangle is more than 49 cm, then the minimum length of the shortest side is :

(1) 11

(2) 9

(3) more than 9

(4) more than 10

29. On a shelf, two books of Mathematics, four books of Physics and three books of Chemistry are placed. How many different collections can be made such that collection has at least one book of each subject ?

(1) 315

(2) 24

(3) 18

(4) 105

30. If ${}^nP_r = 840$ and ${}^nC_r = 35$, then value of r is :

(1) 8
(2) 4
(3) 5
(4) 2

31. The number of parallelograms that can be formed from a set of four parallel lines intersecting another set of three parallel lines is :

(1) 12
(2) 18
(3) 9
(4) 6

32. Rank of 4×4 matrix $\begin{bmatrix} 0 & 1 & 0 & 1 \\ -1 & 0 & 1 & 0 \\ 0 & -1 & 0 & 1 \\ -1 & 0 & -1 & 0 \end{bmatrix}$ is :

(1) 1
(2) 2
(3) 3
(4) 4

33. The Eigen value of the matrix $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ is :

(1) $\{-1, 1\}$
(2) $\{1, 3\}$
(3) $\{-1, 3\}$
(4) $\{-1, 1, 3\}$

34. The characteristic polynomial of matrix $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ is :

(1) $\lambda^3 - 3\lambda^2 + 9\lambda - 5$
(2) $\lambda^3 + 3\lambda^2 - 9\lambda + 5$
(3) $\lambda^3 - 3\lambda^2 - 9\lambda - 5$
(4) $\lambda^3 + 3\lambda^2 - 9\lambda + 5$

35. Numbers 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 are given. If 2 is added to each number, the variance of the number will be :

(1) 8.25
(2) 6.5
(3) 3.87
(4) 4.48

36. The standard deviation of the first 10 natural numbers is :

(1) 5.5
(2) 2.87
(3) 3.77
(4) 2.97

37. Given that $\Sigma f_i = 80$, $\Sigma f_i \ x_i = 4000$ and $\Sigma f_i \left|x_i - \bar{x}\right| = 1280$ for a set of observations. Mean deviation about the mean is :

(1) 50
(2) 13.4
(3) 17.2
(4) 16

38. If the side of a square changes from 3 m to 2.9 m, the approximate change in its area (in m^2) is :

(1) 0.1
(2) 0.6
(3) 0.4
(4) 0.8

39. For a sphere, the rate of change of volume is :

(1) π times the rate of change of radius
(2) Surface area times the rate of change of diameter
(3) Surface area times the rate of change of radius
(4) 2π times the rate of change of radius

40. The slope of tangent to the curve $x = 3t^2 + 1$, $y = t^3 - 1$ at $x = 1$ is :

(1) 0
(2) -2
(3) $\frac{1}{2}$
(4) ∞

41. The function $f(x) = 2x^3 - 15x^2 + 36x + 4$ has maximum value when value of x is :

(1) 3
(2) 0
(3) 4
(4) 2

42. If n is an odd positive integer, then $an + bn$ is divisible by :

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

(2) $a - b$

(3) $a + b$

(4) $2a + b$

43. $10^{2n-1} + 1$, $n \epsilon N$, is divisible by :

(1) 9

(2) 10

(3) 8

(4) 11

44. If m is the mean of a Poisson distribution, then variance is :

(1) m^2

(2) $m^{\frac{1}{2}}$

(3) m

(4) $\frac{m}{2}$

45. If the probability of A to fail in an examination is $\frac{1}{5}$ and that of B to fail is $\frac{3}{10}$, then the probability that either A or B fails is :

(1) $\frac{19}{50}$

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

(3) $\frac{11}{25}$

(4) $\frac{17}{50}$

46. If in a binomial distribution, $n = 4$ and $P(X = 0) = \frac{16}{81}$, then $P(X = 4)$ is equal to :

(1) $\frac{1}{16}$

(2) $\frac{1}{27}$

(3) $\frac{1}{81}$

(4) $\frac{1}{8}$

47. It is given that 6% of the people with blood group O are left handed and 10% of those with other blood group are left handed and 30% of the people have blood group O. If a left handed person is selected at random, the probability that he/she will have blood group O is :

(1) $\frac{35}{44}$

(2) $\frac{9}{44}$

(3) $\frac{11}{125}$

(4) $\frac{77}{125}$

48. If line $y = mx + c$ is tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, then condition of tangency and point of contact (of tangent to the ellipse) are :

(1) $c^2 = a^2m^2 + b^2, \left(\frac{a^2m}{c}, -\frac{b^2}{c}\right)$

(2) $c^2 = a^2m^2 + b^2, \left(-\frac{a^2m}{c}, \frac{b^2}{c}\right)$

(3) $c^2 = a^2m^2 - b^2, \left(-\frac{a^2m}{c}, \frac{-b^2}{c}\right)$

(4) $c^2 = a^2m^2 - b^2, \left(\frac{a^2m}{c}, -\frac{b^2}{c}\right)$

49. If $|\vec{a}| = 4$, $|\vec{b}| = 5$ and $\vec{a} \cdot \vec{b} = 10$, then the value of $|\vec{a} \times \vec{b}|$ is :

(1) $10\sqrt{2}$

(2) 5

(3) $10\sqrt{3}$

(4) 10

50. The position vector of the point which divides the join of points $3\vec{a} - 2\vec{b}$ and $\vec{a} + \vec{b}$ internally in the ratio 3 : 1 is :

(1) $\dfrac{6\vec{a} + \vec{b}}{4}$

(2) $\dfrac{10\vec{a} - 5\vec{b}}{4}$

(3) $\dfrac{10\vec{a} + 5\vec{b}}{4}$

(4) $\dfrac{6\vec{a} - \vec{b}}{4}$

51. The projection of $3\hat{i} + \hat{j} + 2\hat{k}$ on $2\hat{i} - 2\hat{j} + \hat{k}$ is :

(1) $\dfrac{10}{3}$

(2) 2

(3) 10

(4) 3

52. For any vector $\vec{a}$, the value of $\left(\vec{a}\times\hat{i}\right)^2 + \left(\vec{a}\times\hat{j}\right)^2 + \left(\vec{a}\times\hat{k}\right)^2$ is :

(1) $\vec{a}^2$

(2) $3\vec{a}^2$

(3) $4\vec{a}^2$

(4) $2\vec{a}^2$

53. The term without x in the expansion of $\left(\frac{3}{2}x^2 - \frac{1}{3x}\right)^6$ is :

(1) $\frac{20}{3}$

(2) $\frac{5}{24}$

(3) $\frac{5}{12}$

(4) $\frac{135}{4}$

54. The total number of terms in the expansion of $(x+\text{a})^{100}+(x-\text{a})^{100}$ after simplification is :

(1) 202
(2) 51
(3) 50
(4) 52

55. If the coefficients of second, third and fourth terms in the expansion of $(1+x)^{\text{n}}$ are in an A.P., then the value of n is :

(1) 7
(2) 11
(3) 14
(4) 3

56. The sum of n terms of two AP are in the ratio (3n+8) : (7n+15). The ratio of their 12$^{\text{th}}$ term is :

(1) 4 : 9
(2) 3 : 7
(3) 9 : 16
(4) 7 : 16

57. The value of $9^{\frac{1}{3}} \cdot 9^{\frac{1}{9}} \cdot 9^{\frac{1}{27}}$ .... up to ∞, is :

(1) 1
(2) 9
(3) 3
(4) 81

58. The total number of ancestors, i.e. parents, grandparents, great grandparents and so on, that a person has during the ten generations preceding his own is :
(1) 2048
(2) 1024
(3) 1022
(4) 2046

59. In an HP the fourth term is two times the eighth term. The first term of the HP will be :
(1) Two times the third term
(2) Four times the third term
(3) Eight times the seventh term
(4) Seven times the seventh term

60. Evaluation of $\int_{|z|=10.5} z^2 \cot \pi z \, dz$ is equal to :
(1) $1240\, i$
(2) $220\, i$
(3) $1540\, i$
(4) $12100\, i$

61. Which one of the functions e^x ; x^3 ; $\sin x$ and $2x+3$ is not a monotonic function on R ?
(1) e^x
(2) $\sin x$
(3) $2x+3$
(4) x^3

62. The real part of square of a complex number is equal to :
(1) the square of its real part
(2) the square of its imaginary part
(3) the sum of squares of real and imaginary parts
(4) the difference of squares of real and imaginary parts

63. A sphere through three non - collinear points A, B and C is smallest when the centre lies on :
(1) Centroid of ΔABC
(2) The plane ABC
(3) Origin
(4) Orthocenter of ΔABC

64. Vectors $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$, $\vec{b} = 2\hat{i} - 3\hat{j} + \hat{k}$, and $\vec{c} = 3\hat{i} + \hat{j} - 2\hat{k}$ are given. The value of $\left[\vec{a}\ \vec{b}\ \vec{c}\right]$ is :
(1) 14
(2) 28
(3) 24
(4) 20

65. The distance of a point (5, 2, -4) from the plane $\vec{r} \cdot \left(3\hat{i} - 2\hat{j} + 4\hat{k}\right) = 4$ is :

(1) $\frac{9}{\sqrt{29}}$

(2) $\frac{15}{\sqrt{29}}$

(3) $\frac{5}{\sqrt{29}}$

(4) $\frac{9}{\sqrt{50}}$

66. If lines $\frac{x-5}{5\lambda+2} = \frac{2-y}{5} = \frac{1-z}{-1}$ and $\frac{x}{1} = \frac{2y+1}{4\lambda} = \frac{1-z}{-3}$ are perpendicular to each other, then the value of λ is :

(1) -1

(2) 0

(3) 1

(4) $\frac{1}{3}$

67. If function $f(x) = x^3 + x^2 - 6x$ satisfies Lagrange's mean value theorem in $[-1, 4]$, then the value of c is :

(1) 1

(2) 2

(3) -2

(4) -1

68. The set of points where the function $f(x) = |2x-1| \cdot \sin x$, is differentiable is :

(1) $R - \left\{\frac{1}{2}\right\}$

(2) R

(3) $(0, \infty)$

(4) $\frac{1}{2}$

69. If $y = \log\left(\dfrac{1+x^2}{1-x^2}\right)$, then value of $\dfrac{dy}{dx}$ is :

(1) $\dfrac{1}{4-x^4}$

(2) $\dfrac{4x}{1-x^4}$

(3) $\dfrac{4x^3}{1-x^4}$

(4) $-\dfrac{4x}{1-x^4}$

70. $\lim\limits_{x \to \frac{\pi}{4}} \left(\dfrac{\sec^2 x - 2}{\tan x - 1}\right)$ is :

(1) 0
(2) 1
(3) 2
(4) 3

71. Solution of the differential equation $(x+2y^3)dy = y\ dx$, is :

(1) $y = x^3 + c$
(2) $x = y^2 + c$
(3) $x = y^3 + cy$
(4) $y = x^2 + c$

72. Solution of the differential equation $\dfrac{dy}{dx} = e^{x+y}$, is :

(1) $e^{-x} + e^{y} = c$
(2) $e^{x} + e^{-y} = c$
(3) $e^{x} + e^{y} = c$
(4) $e^{-x} + e^{-y} = c$

73. Which of the following is a homogeneous differential equation ?

(1) $(4x+6y+5)dy - (2y+3x+3)dx = 0$
(2) $xy\ dx - (x^3+y^3)dy = 0$
(3) $(x^2+2y^3)dx + 2xy\ dy = 0$
(4) $y^2 dx + (x^2 - xy + y^2)dy = 0$

74. The differential equation for $y = a\cos(\alpha x) + b\sin(\alpha y)$, where a and b are arbitrary constants is :

(1) $\dfrac{d^2y}{dx^2} + \alpha^2 y = 0$

(2) $\dfrac{d^2y}{dx^2} - \alpha^2 y = 0$

(3) $\dfrac{d^2y}{dx^2} - \alpha y = 0$

(4) $\dfrac{d^2y}{dx^2} + \alpha y = 0$

75. The number of divisors and sum of divisors of the number 1800 are :

(1) 24, 2820
(2) 36, 6045
(3) 30, 2015
(4) 36, 3015

76. The area of the region (in sq. units) bounded by the lines $y = x + 1$, $x = 2$ and $x = 3$ is :

(1) $\dfrac{9}{2}$

(2) $\dfrac{11}{2}$

(3) $\dfrac{7}{2}$

(4) $\dfrac{13}{2}$

77. $\int_0^{2a} f(x)\,dx$ is equal to :

(1) $2\int_0^{a} f(x)\,dx$

(2) 0

(3) $\int_0^{a} f(x)\,dx + \int_0^{2a} f(2a - x)\,dx$

(4) $\int_0^{a} f(x)\,dx + \int_0^{a} f(2a - x)\,dx$

78. $\int \frac{x+2}{(x+3)^2} e^x \, dx$ is equal to :

(1) $\frac{e^{-x}}{x-3} + c$

(2) $e^{2x} \cdot \frac{1}{x+3} + c$

(3) $\frac{e^x}{x-3} + c$

(4) $\frac{e^x}{x+3} + c$

79. $\int \frac{dx}{\sqrt{5 - 4x - 2x^2}}$ is equal to :

(1) $\frac{1}{\sqrt{2}} \sin^{-1}\left(\frac{\sqrt{2}\ (x+1)}{\sqrt{7}}\right) + c$

(2) $\sin^{-1}\left(\sqrt{\frac{2}{7}}\ (x+1)\right) + c$

(3) $\frac{1}{2} \sin^{-1}\left(\frac{\sqrt{2}\ (x+1)}{\sqrt{7}}\right) + c$

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

80. A and B are two sets such that $n(A) = 4$ and the number of non - empty relations from A to B is 4095. Then $n(B)$ is equal to :

(1) 4
(2) 5
(3) 3
(4) 2