1. If \( y = 2x^{n+1} + \frac{3}{x^{n}} \) then \( x^2 \frac{d^2y}{dx^2} \) is

(A) \( y \)

(B) \( 6n(n+1)y \)

(C) \( n(n+1)y \)

(D) \( x \frac{dy}{dx} + y \)

4. If the side of a cube is increased by 5%, then the surface area of a cube is increased by

(A) 20%

(B) 10%

(C) 60%

(D) 6%

2. If the curves \( 2x = y^2 \) and \( 2xy = K \) intersect perpendicularly, then the value of \( K^2 \) is

(A) \( 8 \)

(B) \( 4 \)

(C) \( 2 \sqrt{2} \)

(D) \( 2 \)

5. The value of \( \int \frac{1+x^4}{1+x^6} \, dx \) is

(A) \( \tan^{-1} x + \frac{1}{3} \tan^{-1} x^2 + C \)

(B) \( \tan^{-1} x + \tan^{-1} x^3 + C \)

(C) \( \tan^{-1} x + \frac{1}{3} \tan^{-1} x^3 + C \)

(D) \( \tan^{-1} x - \frac{1}{3} \tan^{-1} x^3 + C \)

3. If \((xe)^y = e^x\), then \( \frac{dy}{dx} \) is

(A) \( \frac{e^x}{x(y-1)} \)

(B) \( \frac{\log x}{(1 + \log x)^2} \)

(C) \( \frac{1}{(1 + \log x)^2} \)

(D) \( \frac{\log x}{(1 + \log x)} \)

6. The maximum value of \( \frac{\log x}{x} \), if \( x > 0 \) is

(A) \( -\frac{1}{e} \)

(B) \( e \)

(C) \( \frac{1}{e} \)

(D) \( \frac{1}{e} \)
7. The value of $\int e^{\sin x} \sin 2x \, dx$ is

(A) $2 e^{\sin x} (\cos x - 1) + C$
(B) $2 e^{\sin x} (\sin x - 1) + C$
(C) $2 e^{\sin x} (\sin x + 1) + C$
(D) $2 e^{\sin x} (\cos x + 1) + C$

8. The value of $\int \cos^{-1} x \, dx$ is

$\frac{1}{2}$

(A) $\frac{\pi^2}{2}$
(B) $\pi$
(C) $\frac{\pi}{2}$
(D) 1

9. If $\int \frac{3x + 1}{(x - 1) (x - 2) (x - 3)} \, dx$

$= A \log |x - 1| + B \log |x - 2| + C \log |x - 3| + C$, then the values of $A$, $B$ and $C$ are respectively.

(A) 2, -7, 5
(B) 5, -7, -5
(C) 2, -7, -5
(D) 5, -7, 5

10. The value of $\int_0^1 \frac{\log (1 + x)}{1 + x^2} \, dx$ is

(A) $\frac{\pi}{8} \log 2$
(B) $\frac{\pi}{2} \log 2$
(C) $\frac{\pi}{4} \log 2$
(D) $\frac{1}{2}$

11. The area of the region bounded by the curve $y^2 = 8x$ and the line $y = 2x$ is

(A) $\frac{8}{3}$ sq. units
(B) $\frac{16}{3}$ sq. units
(C) $\frac{4}{3}$ sq. units
(D) $\frac{3}{4}$ sq. units

12. The value of $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \cos x \, dx$ is

(A) $-2$
(B) 2
(C) 0
(D) $\frac{1}{2}$
13. The order of the differential equation obtained by eliminating arbitrary constants in the family of curves
\[ c_1 y = (c_2 + c_3) e^{x+c_4} \] is
(A) 4 \hspace{1cm} (B) 1
(C) 2 \hspace{1cm} (D) 3

14. The general solution of the differential equation \( x^2 dy - 2xydx = x^4 \cos x \, dx \) is
(A) \( y = \cos x + cx^2 \)
(B) \( y = x^2 \sin x + cx \)
(C) \( y = x^2 \sin x + c \)
(D) \( y = \sin x + cx^2 \)

16. The two vectors \( \hat{i} + \hat{j} + \hat{k} \) and \( \hat{i} + 3\hat{j} + 5\hat{k} \) represent the two sides \( \overrightarrow{AB} \) and \( \overrightarrow{AC} \) respectively of a \( \triangle ABC \). The length of the median through \( A \) is
(A) \( \sqrt{14} \) \hspace{1cm} (B) \( \frac{\sqrt{14}}{2} \)
(C) 14 \hspace{1cm} (D) 7

17. If \( \overrightarrow{a} \) and \( \overrightarrow{b} \) are unit vectors and \( \theta \) is the angle between \( \overrightarrow{a} \) and \( \overrightarrow{b} \), then \( \sin \frac{\theta}{2} \) is
(A) \( |\overrightarrow{a} - \overrightarrow{b}| \) \hspace{1cm} (B) \( |\overrightarrow{a} + \overrightarrow{b}| \)
(C) \( \frac{|\overrightarrow{a} + \overrightarrow{b}|}{2} \) \hspace{1cm} (D) \( \frac{|\overrightarrow{a} - \overrightarrow{b}|}{2} \)

18. The curve passing through the point (1, 2) given that the slope of the tangent at any point \((x, y)\) is \( \frac{2x}{y} \) represents
(A) Hyperbola \hspace{1cm} (B) Circle
(C) Parabola \hspace{1cm} (D) Ellipse
19. If \(|\mathbf{a} \times \mathbf{b}|^2 + |\mathbf{a} \cdot \mathbf{b}|^2 = 144\) and \(|\mathbf{a}| = 6\), then \(|\mathbf{b}|\) is equal to

(A) 4  
(B) 6  
(C) 3  
(D) 2

20. The point \((1, -3, 4)\) lies in the octant

(A) Eighth  
(B) Fourth  
(C) Third  
(D) Second

21. If the vectors

\(2\hat{i} - 3\hat{j} + 4\hat{k}, 2\hat{i} + \hat{j} - \hat{k}\) and \(\lambda\hat{i} - \hat{j} + 2\hat{k}\)

are coplanar, then the value of \(\lambda\) is

(A) 5  
(B) 6  
(C) -5  
(D) -6

22. The distance of the point \((1, 2, -4)\) from the line \(\frac{x-3}{2} = \frac{y-3}{3} = \frac{z+5}{6}\) is

(A) \(\sqrt{293}\)  
(B) \(\frac{293}{7}\)  
(C) \(\frac{\sqrt{293}}{7}\)  
(D) \(\frac{293}{49}\)

23. The sine of the angle between the straight line \(\frac{x-2}{3} = \frac{3-y}{-4} = \frac{z-4}{5}\) and the plane \(2x - 2y + z = 5\) is

(A) \(\frac{\sqrt{2}}{10}\)  
(B) \(\frac{3}{\sqrt{50}}\)  
(C) \(\frac{3}{50}\)  
(D) \(\frac{4}{5\sqrt{2}}\)

24. If a line makes an angle of \(\frac{\pi}{3}\) with each of \(x\) and \(y\)-axis, then the acute angle made by \(z\)-axis is

(A) \(\frac{\pi}{2}\)  
(B) \(\frac{\pi}{4}\)  
(C) \(\frac{\pi}{6}\)  
(D) \(\frac{\pi}{3}\)
25. Corner points of the feasible region determined by the system of linear constraints are (0, 3), (1, 1) and (3, 0). Let \( z = px + qy \), where \( p, q > 0 \). Condition on \( p \) and \( q \) so that the minimum of \( z \) occurs at (3, 0) and (1, 1) is

(A) \( p = q \)
(B) \( p = 2q \)
(C) \( p = \frac{q}{2} \)
(D) \( p = 3q \)

26. The feasible region of an LPP is shown in the figure. If \( Z = 11x + 7y \), then the maximum value of \( Z \) occurs at

(A) (3, 2) (B) (0, 5)
(C) (3, 3) (D) (5, 0)

27. A die is thrown 10 times, the probability that an odd number will come up at least one time is

(A) \( \frac{1013}{1024} \)
(B) \( \frac{1}{1024} \)
(C) \( \frac{1023}{1024} \)
(D) \( \frac{11}{1024} \)

28. If \( A \) and \( B \) are two events such that \( P(A) = \frac{1}{3} \), \( P(B) = \frac{1}{2} \) and \( P(A \cap B) = \frac{1}{6} \), then \( P(A' \mid B) \) is

(A) \( \frac{1}{12} \)
(B) \( \frac{2}{3} \)
(C) \( \frac{1}{3} \)
(D) \( \frac{1}{2} \)
35. If \( z = x + iy \), then the equation \(|z + 1| = |z - 1|\) represents

(A) \( y \)-axis  (B) a circle
(C) a parabola  (D) \( x \)-axis

36. The value of
\[ 16^C_9 + 16^C_{10} - 16^C_6 - 16^C_7 \]
is

(A) \( 17^C_3 \)  (B) \( 0 \)
(C) \( 1 \)  (D) \( 17^C_{10} \)

37. The number of terms in the expansion of \((x + y + z)^{10}\) is

(A) 110  (B) 66
(C) 142  (D) 11

38. If \( P(n) : 2^n < n! \)

Then the smallest positive integer for which \( P(n) \) is true if

(A) 5  (B) 2
(C) 3  (D) 4

39. The two lines \( lx + my = n \) and \( l'x + m'y = n' \) are perpendicular if

(A) \( lm' + ml' = 0 \)
(B) \( ll' + mm' = 0 \)
(C) \( lm' = ml' \)
(D) \( lm + l'm' = 0 \)

40. If the parabola \( x^2 = 4ay \) passes through the point \( (2, 1) \), then the length of the latus rectum is

(A) 8  (B) 1
(C) 4  (D) 2

41. If the sum of \( n \) terms of an A.P. is given by \( S_n = n^2 + n \), then the common difference of the A.P. is

(A) 6  (B) 4
(C) 1  (D) 2
42. The negation of the statement "For all real numbers \( x \) and \( y \), \( x + y = y + x \)" is
   (A) for some real numbers \( x \) and \( y \),
   \[ x - y = y - x \]
   (B) for all real numbers \( x \) and \( y \),
   \[ x + y \neq y + x \]
   (C) for some real numbers \( x \) and \( y \),
   \[ x + y = y + x \]
   (D) for some real numbers \( x \) and \( y \),
   \[ x + y \neq y + x \]

43. The standard deviation of the data
   \[ 6, 7, 8, 9, 10 \]
   is
   (A) 10
   (B) \( \sqrt{2} \)
   (C) \( \sqrt{10} \)
   (D) 2

44. \( \lim_{x \to 0} \left( \frac{\tan x}{\sqrt{2x + 4} - 2} \right) \) is equal to
   (A) 6
   (B) 2
   (C) 3
   (D) 4

45. If a relation \( R \) on the set \( \{1, 2, 3\} \) be defined by \( R = \{(1, 1)\} \), then \( R \) is
   (A) Only symmetric
   (B) Reflexive and symmetric
   (C) Reflexive and transitive
   (D) Symmetric and transitive

46. Let \( f : [2, \infty) \to \mathbb{R} \) be the function defined by \( f(x) = x^2 - 4x + 5 \), then the range of \( f \) is
   (A) [5, \infty)
   (B) (\(-\infty, \infty\))
   (C) [1, \infty)
   (D) (1, \infty)

47. If \( A, B, C \) are three mutually exclusive and exhaustive events of an experiment such that \( P(A) = 2P(B) = 3P(C) \), then \( P(B) \) is equal to
   (A) \( \frac{4}{11} \)
   (B) \( \frac{1}{11} \)
   (C) \( \frac{2}{11} \)
   (D) \( \frac{3}{11} \)
48. The domain of the function defined by 
\[ f(x) = \cos^{-1}\sqrt{x - 1} \] is 
(A) \([0, 1]\) (B) \([1, 2]\) 
(C) \([0, 2]\) (D) \([-1, 1]\)

49. The value of 
\[ \cos\left(\sin^{-1} \frac{\pi}{3} + \cos^{-1} \frac{\pi}{3}\right) \] is 
(A) Does not exist 
(B) 0 
(C) 1 
(D) -1

50. If \( A = \begin{pmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix} \), then \( A^4 \) is equal to 
(A) 4A 
(B) A 
(C) 2A 
(D) I

51. If \( A = \{a, b, c\} \), then the number of binary operations on \( A \) is 
(A) \(3^6\) 
(B) 3 
(C) \(3^6\) 
(D) \(3^3\)

52. If \( \begin{pmatrix} 2 & 1 \\ 3 & 2 \end{pmatrix} A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \), then the matrix \( A \) is 
(A) \( \begin{pmatrix} 2 & -1 \\ 3 & 2 \end{pmatrix} \) 
(B) \( \begin{pmatrix} 2 & 1 \\ 3 & 2 \end{pmatrix} \) 
(C) \( \begin{pmatrix} 2 & -1 \\ -3 & 2 \end{pmatrix} \) 
(D) \( \begin{pmatrix} -2 & 1 \\ 3 & -2 \end{pmatrix} \)

53. If \( f(x) = \begin{vmatrix} x^3 - x & a + x & b + x \\ x - a & x^2 - x & c + x \\ x - b & x - c & 0 \end{vmatrix} \), then 
(A) \( f(-1) = 0 \) 
(B) \( f(1) = 0 \) 
(C) \( f(2) = 0 \) 
(D) \( f(0) = 0 \)

54. If \( A \) and \( B \) are square matrices of same order and \( B \) is a skew symmetric matrix, then \( A'BA \) is 
(A) Skew symmetric matrix 
(B) Symmetric matrix 
(C) Null matrix 
(D) Diagonal matrix
55. If $A$ is a square matrix of order 3 and $|A| = 5$, then $|A \text{adj} A|$ is
   (A) 625  (B) 5  (C) 125  (D) 25

56. If $f(x) = \begin{cases} \frac{1 - \cos Kx}{x \sin x}, & \text{if } x \neq 0 \\ \frac{1}{2}, & \text{if } x = 0 \end{cases}$ is continuous at $x = 0$, then the value of $K$ is
   (A) $\pm 1$  (B) $\pm \frac{1}{2}$  (C) 0  (D) $\pm 2$

57. If $a_1, a_2, a_3, \ldots, a_9$ are in A.P. then the value of $\begin{vmatrix} a_1 & a_2 & a_3 \\ a_4 & a_5 & a_6 \\ a_7 & a_8 & a_9 \end{vmatrix}$ is
   (A) 1  (B) $\frac{9}{2} (a_1 + a_9)$  (C) $a_1 + a_9$  (D) $\log_e (\log_e e)$

58. If $2^x + 2^y = 2^x + y$, then $\frac{dy}{dx}$ is
   (A) $\frac{2^y - 1}{2^x - 1}$  (B) $2^y - x$  (C) $-2^y - x$  (D) $2^x - y$

59. If $f(x) = \sin^{-1} \left( \frac{2x}{1 + x^2} \right)$, then $f'(\sqrt{3})$ is
   (A) $-\frac{1}{\sqrt{3}}$  (B) $-\frac{1}{2}$  (C) $\frac{1}{\sqrt{3}}$  (D) $\frac{1}{2}$

60. The right hand and left hand limit of the function
   $f(x) = \begin{cases} \frac{e^{1/x} - 1}{e^{1/x} + 1}, & \text{if } x \neq 0 \\ 0, & \text{if } x = 0 \end{cases}$ are respectively
   (A) $-1$ and $1$  (B) $1$ and $1$  (C) $1$ and $-1$  (D) $-1$ and $-1$