

1. The solution of $e^{\frac{dy}{dx}} = x + 1, y(0) = 3$ is

(A) $y - 2 = x \log x - x$

(B) $y - x - 3 = x \log x$

(C) $y - x - 3 = (x + 1) \log (x + 1)$

(D) $y + x - 3 = (x + 1) \log (x + 1)$

2. The family of curves whose x and y intercepts of a tangent at any point are respectively double the x and y coordinates of that point is

(A) $xy = C$

(B) $x^2 + y^2 = C$

(C) $x^2 - y^2 = C$

(D) $\frac{y}{x} = C$

3. The vectors $\vec{AB} = 3\hat{i} + 4\hat{k}$ and $\vec{AC} = 5\hat{i} - 2\hat{j} + 4\hat{k}$ are the sides of a ΔABC . The length of the median through A is

(A) $\sqrt{18}$

(B) $\sqrt{72}$

(C) $\sqrt{33}$

(D) $\sqrt{288}$

4. The volume of the parallelopiped whose co-terminous edges are $\hat{j} + \hat{k}, \hat{i} + \hat{k}$ and $\hat{i} + \hat{j}$ is

(A) 6 cu. units

(B) 2 cu. units

(C) 4 cu. units

(D) 3 cu. units

5. Let \vec{a} and \vec{b} be two unit vectors and θ is the angle between them. Then $\vec{a} + \vec{b}$ is a unit vector if

(A) $\theta = \frac{\pi}{4}$

(B) $\theta = \frac{\pi}{3}$

(C) $\theta = \frac{2\pi}{3}$

(D) $\theta = \frac{\pi}{2}$

6. If \vec{a} , \vec{b} , \vec{c} are three non-coplanar vectors and p , q , r are vectors defined by

$$\vec{p} = \frac{\vec{b} \times \vec{c}}{[\vec{a} \ \vec{b} \ \vec{c}]}, \quad \vec{q} = \frac{\vec{c} \times \vec{a}}{[\vec{a} \ \vec{b} \ \vec{c}]}, \quad \vec{r} = \frac{\vec{a} \times \vec{b}}{[\vec{a} \ \vec{b} \ \vec{c}]}, \text{ then}$$

$$(\vec{a} + \vec{b}) \cdot \vec{p} + (\vec{b} + \vec{c}) \cdot \vec{q} + (\vec{c} + \vec{a}) \cdot \vec{r} \text{ is}$$

- (A) 0 (B) 1 (C) 2 (D) 3

7. If lines $\frac{x-1}{-3} = \frac{y-2}{2k} = \frac{z-3}{2}$ and $\frac{x-1}{3k} = \frac{y-5}{1} = \frac{z-6}{-5}$ are mutually perpendicular,

then k is equal to

- (A) $-\frac{10}{7}$ (B) $-\frac{7}{10}$ (C) -10 (D) -7

8. The distance between the two planes $2x + 3y + 4z = 4$ and $4x + 6y + 8z = 12$ is

- (A) 2 units (B) 8 units (C) $\frac{2}{\sqrt{29}}$ units (D) 4 units

9. The sine of the angle between the straight line $\frac{x-2}{3} = \frac{y-3}{4} = \frac{4-z}{-5}$ and the plane

$$2x - 2y + z = 5 \text{ is}$$

- (A) $\frac{1}{5\sqrt{2}}$ (B) $\frac{2}{5\sqrt{2}}$ (C) $\frac{3}{50}$ (D) $\frac{3}{\sqrt{50}}$

10. The equation $xy = 0$ in three-dimensional space represents

- (A) a pair of straight lines
(B) a plane
(C) a pair of planes at right angles
(D) a pair of parallel planes

11. The plane containing 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) $x + 2y - z = 1$ (D) $2x - y + z = 5$

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12. Corner points of the feasible region for an LPP are $(0, 2)$, $(3, 0)$, $(6, 0)$, $(6, 8)$ and $(0, 5)$. Let $z = 4x + 6y$ be the objective function. The minimum value of z occurs at

(A) Only $(0, 2)$

(B) Only $(3, 0)$

(C) The mid-point of the line segment joining the points $(0, 2)$ and $(3, 0)$

(D) Any point on the line segment joining the points $(0, 2)$ and $(3, 0)$

13. A die is thrown 10 times. The probability that an odd number will come up at least once is

(A) $\frac{11}{1024}$

(B) $\frac{1013}{1024}$

(C) $\frac{1023}{1024}$

(D) $\frac{1}{1024}$

14. A random variable X has the following probability distribution :

X	0	1	2
P(X)	$\frac{25}{36}$	k	$\frac{1}{36}$

If the mean of the random variable X is $\frac{1}{3}$, then the variance is

(A) $\frac{1}{18}$

(B) $\frac{5}{18}$

(C) $\frac{7}{18}$

(D) $\frac{11}{18}$

15. If a random variable X follows the binomial distribution with parameters $n = 5$, p and $P(X = 2) = 9P(X = 3)$, then p is equal to

(A) 10

(B) $\frac{1}{10}$

(C) 5

(D) $\frac{1}{5}$

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16. Two finite sets have m and n elements respectively. The total number of subsets of the first set is 56 more than the total number of subsets of the second set. The values of m and n respectively are
- (A) 7, 6 (B) 5, 1 (C) 6, 3 (D) 8, 7
17. If $[x]^2 - 5[x] + 6 = 0$, where $[x]$ denotes the greatest integer function, then
- (A) $x \in [3, 4]$ (B) $x \in [2, 4)$ (C) $x \in [2, 3]$ (D) $x \in (2, 3]$
18. If in two circles, arcs of the same length subtend angles 30° and 78° at the centre, then the ratio of their radii is
- (A) $\frac{5}{13}$ (B) $\frac{13}{5}$ (C) $\frac{13}{4}$ (D) $\frac{4}{13}$
19. If ΔABC is right angled at C , then the value of $\tan A + \tan B$ is
- (A) $a + b$ (B) $\frac{a^2}{bc}$ (C) $\frac{c^2}{ab}$ (D) $\frac{b^2}{ac}$
20. The real value of ' α ' for which $\frac{1 - i \sin \alpha}{1 + 2i \sin \alpha}$ is purely real is
- (A) $(n + 1)\frac{\pi}{2}, n \in \mathbb{N}$ (B) $(2n + 1)\frac{\pi}{2}, n \in \mathbb{N}$
 (C) $n\pi, n \in \mathbb{N}$ (D) $(2n - 1)\frac{\pi}{2}, n \in \mathbb{N}$
21. The length of a rectangle is five times the breadth. If the minimum perimeter of the rectangle is 180 cm, then
- (A) Breadth ≤ 15 cm (B) Breadth ≥ 15 cm
 (C) Length ≤ 15 cm (D) Length = 15 cm
22. The value of ${}^{49}C_3 + {}^{48}C_3 + {}^{47}C_3 + {}^{46}C_3 + {}^{45}C_3 + {}^{45}C_4$ is
- (A) ${}^{50}C_4$ (B) ${}^{50}C_3$
 (C) ${}^{50}C_2$ (D) ${}^{50}C_1$

23. In the expansion of $(1+x)^n$

$$\frac{C_1}{C_0} + 2\frac{C_2}{C_1} + 3\frac{C_3}{C_2} + \dots + n\frac{C_n}{C_{n-1}} \text{ is equal to}$$

- (A) $\frac{n(n+1)}{2}$ (B) $\frac{n}{2}$ (C) $\frac{n+1}{2}$ (D) $3n(n+1)$

24. If S_n stands for sum to n -terms of a G.P. with 'a' as the first term and 'r' as the common ratio then $S_n : S_{2n}$ is

- (A) $r^n + 1$ (B) $\frac{1}{r^n + 1}$ (C) $r^n - 1$ (D) $\frac{1}{r^n - 1}$

25. If A.M. and G.M. of roots of a quadratic equation are 5 and 4 respectively, then the quadratic equation is

- (A) $x^2 - 10x - 16 = 0$
(B) $x^2 + 10x + 16 = 0$
(C) $x^2 + 10x - 16 = 0$
(D) $x^2 - 10x + 16 = 0$

26. The angle between the line $x + y = 3$ and the line joining the points (1, 1) and (-3, 4) is

- (A) $\tan^{-1}(7)$ (B) $\tan^{-1}\left(-\frac{1}{7}\right)$
(C) $\tan^{-1}\left(\frac{1}{7}\right)$ (D) $\tan^{-1}\left(\frac{2}{7}\right)$

27. The equation of parabola whose focus is (6, 0) and directrix is $x = -6$ is

- (A) $y^2 = 24x$ (B) $y^2 = -24x$
(C) $x^2 = 24y$ (D) $x^2 = -24y$

28. $\lim_{x \rightarrow \frac{\pi}{4}} \frac{\sqrt{2} \cos x - 1}{\cot x - 1}$ is equal to

- (A) 2 (B) $\sqrt{2}$ (C) $\frac{1}{2}$ (D) $\frac{1}{\sqrt{2}}$

29. The negation of the statement

“For every real number x ; $x^2 + 5$ is positive”
is

- (A) For every real number x ; $x^2 + 5$ is not positive.
(B) For every real number x ; $x^2 + 5$ is negative.
(C) There exists at least one real number x such that $x^2 + 5$ is not positive.
(D) There exists at least one real number x such that $x^2 + 5$ is positive.

30. Let a, b, c, d and e be the observations with mean m and standard deviation S . The standard deviation of the observations $a + k, b + k, c + k, d + k$ and $e + k$ is

- (A) kS (B) $S + k$ (C) $\frac{S}{k}$ (D) S

31. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be given by $f(x) = \tan x$. Then $f^{-1}(1)$ is

- (A) $\frac{\pi}{4}$ (B) $\{n\pi + \frac{\pi}{4} : n \in \mathbb{Z}\}$
(C) $\frac{\pi}{3}$ (D) $\{n\pi + \frac{\pi}{3} : n \in \mathbb{Z}\}$

32. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be defined by $f(x) = x^2 + 1$. Then the pre images of 17 and -3 respectively are

- (A) $\phi, \{4, -4\}$ (B) $\{3, -3\}, \phi$
(C) $\{4, -4\}, \phi$ (D) $\{4, -4\}, \{2, -2\}$

33. Let $(g \circ f)(x) = \sin x$ and $(f \circ g)(x) = (\sin \sqrt{x})^2$. Then
- (A) $f(x) = \sin^2 x$, $g(x) = x$ (B) $f(x) = \sin \sqrt{x}$, $g(x) = \sqrt{x}$
(C) $f(x) = \sin^2 x$, $g(x) = \sqrt{x}$ (D) $f(x) = \sin \sqrt{x}$, $g(x) = x^2$
34. Let $A = \{2, 3, 4, 5, \dots, 16, 17, 18\}$. Let R be the relation on the set A of ordered pairs of positive integers defined by $(a, b) R (c, d)$ if and only if $ad = bc$ for all $(a, b), (c, d)$ in $A \times A$. Then the number of ordered pairs of the equivalence class of $(3, 2)$ is
- (A) 4 (B) 5 (C) 6 (D) 7
35. If $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = 3\pi$, then $x(y+z) + y(z+x) + z(x+y)$ equals to
- (A) 0 (B) 1 (C) 6 (D) 12
36. If $2 \sin^{-1} x - 3 \cos^{-1} x = 4$, $x \in [-1, 1]$ then $2 \sin^{-1} x + 3 \cos^{-1} x$ is equal to
- (A) $\frac{4 - 6\pi}{5}$ (B) $\frac{6\pi - 4}{5}$ (C) $\frac{3\pi}{2}$ (D) 0
37. If A is a square matrix such that $A^2 = A$, then $(I + A)^3$ is equal to
- (A) $7A - I$ (B) $7A$ (C) $7A + I$ (D) $I - 7A$
38. If $A = \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$, then A^{10} is equal to
- (A) $2^8 A$ (B) $2^9 A$ (C) $2^{10} A$ (D) $2^{11} A$
39. If $f(x) = \begin{vmatrix} x-3 & 2x^2-18 & 2x^3-81 \\ x-5 & 2x^2-50 & 4x^3-500 \\ 1 & 2 & 3 \end{vmatrix}$, then $f(1) \cdot f(3) + f(3) \cdot f(5) + f(5) \cdot f(1)$ is
- (A) -1 (B) 0 (C) 1 (D) 2

40. If $P = \begin{bmatrix} 1 & \alpha & 3 \\ 1 & 3 & 3 \\ 2 & 4 & 4 \end{bmatrix}$ is the adjoint of a 3×3 matrix A and $|A| = 4$, then α is equal to

- (A) 4 (B) 5
(C) 11 (D) 0

41. If $A = \begin{bmatrix} x & 1 \\ 1 & x \end{bmatrix}$ and $B = \begin{bmatrix} x & 1 & 1 \\ 1 & x & 1 \\ 1 & 1 & x \end{bmatrix}$, then $\frac{dB}{dx}$ is

- (A) $3A$ (B) $-3B$
(C) $3B + 1$ (D) $1 - 3A$

42. Let $f(x) = \begin{vmatrix} \cos x & x & 1 \\ 2 \sin x & x & 2x \\ \sin x & x & x \end{vmatrix}$. Then $\lim_{x \rightarrow 0} \frac{f(x)}{x^2} =$

- (A) -1 (B) 0
(C) 3 (D) 2

43. Which one of the following observations is correct for the features of logarithm function to any base $b > 1$?

- (A) The domain of the logarithm function is \mathbb{R} , the set of real numbers.
(B) The range of the logarithm function is \mathbb{R}^+ , the set of all positive real numbers.
(C) The point $(1, 0)$ is always on the graph of the logarithm function.
(D) The graph of the logarithm function is decreasing as we move from left to right.

44. The function $f(x) = |\cos x|$ is

- (A) everywhere continuous and differentiable
(B) everywhere continuous but not differentiable at odd multiples of $\frac{\pi}{2}$
(C) neither continuous nor differentiable at $(2n + 1)\frac{\pi}{2}$, $n \in \mathbb{Z}$
(D) not differentiable everywhere

45. If $y = 2x^{3x}$, then $\frac{dy}{dx}$ at $x = 1$ is

- (A) 2 (B) 6 (C) 3 (D) 1

46. Let the function satisfy the equation $f(x + y) = f(x) f(y)$ for all $x, y \in \mathbb{R}$, where $f(0) \neq 0$.
If $f(5) = 3$ and $f'(0) = 2$, then $f'(5)$ is

- (A) 6 (B) 0 (C) 5 (D) -6

47. The value of C in $(0, 2)$ satisfying the mean value theorem for the function $f(x) = x(x - 1)^2$,
 $x \in [0, 2]$ is equal to

- (A) $\frac{3}{4}$ (B) $\frac{4}{3}$ (C) $\frac{1}{3}$ (D) $\frac{2}{3}$

48. $\frac{d}{dx} \left[\cos^2 \left(\cot^{-1} \sqrt{\frac{2+x}{2-x}} \right) \right]$ is

- (A) $-\frac{3}{4}$ (B) $-\frac{1}{2}$ (C) $\frac{1}{2}$ (D) $\frac{1}{4}$

49. For the function $f(x) = x^3 - 6x^2 + 12x - 3$; $x = 2$ is

- (A) a point of minimum (B) a point of inflexion
(C) not a critical point (D) a point of maximum

50. The function x^x ; $x > 0$ is strictly increasing at

- (A) $\forall x \in \mathbb{R}$ (B) $x < \frac{1}{e}$ (C) $x > \frac{1}{e}$ (D) $x < 0$

51. The maximum volume of the right circular cone with slant height 6 units is

- (A) $4\sqrt{3}\pi$ cubic units (B) $16\sqrt{3}\pi$ cubic units
(C) $3\sqrt{3}\pi$ cubic units (D) $6\sqrt{3}\pi$ cubic units

52. If $f(x) = x e^{x(1-x)}$ then $f(x)$ is

- (A) increasing in \mathbb{R} (B) decreasing in \mathbb{R}
(C) decreasing in $\left[-\frac{1}{2}, 1\right]$ (D) increasing in $\left[-\frac{1}{2}, 1\right]$

53. $\int \frac{\sin x}{3 + 4 \cos^2 x} dx =$

- (A) $-\frac{1}{2\sqrt{3}} \tan^{-1} \left(\frac{2 \cos x}{\sqrt{3}} \right) + C$ (B) $\frac{1}{\sqrt{3}} \tan^{-1} \left(\frac{\cos x}{3} \right) + C$
(C) $\frac{1}{2\sqrt{3}} \tan^{-1} \left(\frac{\cos x}{3} \right) + C$ (D) $-\frac{1}{\sqrt{3}} \tan^{-1} \left(\frac{2 \cos x}{3} \right) + C$

54. $\int_{-\pi}^{\pi} (1-x^2) \sin x \cdot \cos^2 x dx =$

- (A) $\pi - \frac{\pi^2}{3}$ (B) $2\pi - \pi^3$
(C) $\pi - \frac{\pi^3}{2}$ (D) 0

55. $\int \frac{1}{x[6(\log x)^2 + 7\log x + 2]} dx =$

(A) $\frac{1}{2} \log \left| \frac{2\log x + 1}{3\log x + 2} \right| + C$

(C) $\log \left| \frac{3\log x + 2}{2\log x + 1} \right| + C$

(B) $\log \left| \frac{2\log x + 1}{3\log x + 2} \right| + C$

(D) $\frac{1}{2} \log \left| \frac{3\log x + 2}{2\log x + 1} \right| + C$

56. $\int \frac{\sin \frac{5x}{2}}{\sin \frac{x}{2}} dx =$

(A) $2x + \sin x + 2 \sin 2x + C$

(C) $x + 2 \sin x + \sin 2x + C$

(B) $x + 2 \sin x + 2 \sin 2x + C$

(D) $2x + \sin x + \sin 2x + C$

57. $\int_1^5 (|x-3| + |1-x|) dx =$

(A) 12

(B) $\frac{5}{6}$

(C) 21

(D) 10

58. $\lim_{n \rightarrow \infty} \left(\frac{n}{n^2+1^2} + \frac{n}{n^2+2^2} + \frac{n}{n^2+3^2} + \dots + \frac{1}{5n} \right) =$

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

(B) $\tan^{-1} 3$

(C) $\tan^{-1} 2$

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

59. The area of the region bounded by the line $y = 3x$ and the curve $y = x^2$ in sq. units is

(A) 10

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

(C) 9

(D) 5

60. The area of the region bounded by the line $y = x$ and the curve $y = x^3$ is

(A) 0.2 sq. units

(B) 0.3 sq. units

(C) 0.4 sq. units

(D) 0.5 sq. units