1. If the projection of a line segment on x, y and z axes are 4, 2, $\sqrt{21}$ respectively, then length of the line segment is

(A) $6+\sqrt{21}$

(B) $\sqrt{41}$

(C) $4+2\sqrt{21}$

(D) $\sqrt{43}$

2. The equations of common tangents to the circle $x^2 + y^2 = 8$ and parabola $y^2 = 16x$ are

(A) $x = \pm (y + 2)$

(B) $x = \pm (y + 4)$

(C) $y = \pm (x + 2)$

(D) $y = \pm (x + 4)$

3. If p, q, r are in Arithmetic Progression, then $px + qy + r = 0$ represents a

(A) point

(B) single line

(C) family of concurrent lines

(D) family of circles

Space for Rough Work

4. The tangents drawn at any point on these two curves $3x^2y - y^3 - 2 = 0$ and $x^3 - 3xy^2 + 2 = 0$ cut at

(A) 90°

(B) 60°

(C) 45°

(D) 30°

5. The smaller of the two areas enclosed between the ellipse $\frac{x^2}{4} + \frac{y^2}{16} = 1$ and the line $\frac{x}{2} + \frac{y}{4} = 1$ is

(A) $2\pi - 4$

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

(C) $2\pi^2$

(D) $\frac{\pi^2}{8}$

6. For some natural number n, if $\sum n = 55$, then $\sum n^2$ is

(A) 3125

(B) 605

(C) 1025

(D) 385

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7. If the sum of two of the roots of $x^3 + ax^2 + bx + c = 0$ is zero, then the value of ab is

(A) 2c

(B) 3c

(C) – c

(D) c

8. The value of the sum $^{18}C_2 + {}^{18}C_4 + {}^{18}C_6 + \cdots \cdots + {}^{18}C_{18}$ is

(A) $2^{17} - 1$

(B) $2^{18} - 1$

(C) $2^{19} - 1$

(D) 2^{18}

9. The sum of the series $1 + \frac{x}{2} + \frac{x(x-1)}{2.4} + \frac{x(x-1)(x-2)}{2.4.6} + \cdots \cdots$ to ∞ is

(A) $\left(\frac{3}{4}\right)^x$

(B) $\left(\frac{4}{3}\right)^x$

(C) $\left(\frac{3}{2}\right)^x$

(D) $\left(-\frac{3}{2}\right)^x$

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10. The value of $5^{\frac{1}{2}} . 5^{\frac{1}{4}} . 5^{\frac{1}{8}}$ …… to ∞ is

(A) 25

(B) 5

(C) 125

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

11. The product of all n^{th} roots of unity $(n > 1)$ is

(A) 1

(B) $(n)^{n-1}$

(C) 0

(D) $(-1)^{n-1}$

12. If α, β, γ are the direction cosines of a line then for some real number c, the value of $c[\cos 2\alpha + \cos 2\beta + \cos 2\gamma]$ is

(A) $-c$

(B) 0

(C) 2c

(D) c

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13. If $\vec{a} = 3\hat{i} - 5\hat{j}$; $\vec{b} = 6\hat{i} + 3\hat{j}$ and $\vec{c} = \vec{a} \times \vec{b}$, then $|\vec{a}| : |\vec{c}| : |\vec{b}| =$

(A) 34 : 39 : 45

(B) 39 : 35 : 34

(C) $\sqrt{34} : 39 : \sqrt{45}$

(D) $\sqrt{34} : \sqrt{39} : \sqrt{45}$

14. If $\vec{a}, \vec{b}$ are non-collinear vectors and x, y are scalars such that

$$(2\vec{a} - \vec{b})x + (2\vec{b} - \vec{a})y + (\vec{a} + 2\vec{b}) = \vec{0}, \text{ then}$$

(A) $x = -\frac{4}{3}, y = -\frac{5}{3}$

(B) $x = -\frac{4}{3}, y = \frac{5}{3}$

(C) $x = 0, y = 4$

(D) $x = \frac{5}{3}, y = \frac{4}{3}$

15. If ABCD is a square, then $\overrightarrow{AB} + 2\overrightarrow{BC} + 3\,\overrightarrow{CD} + 4\overrightarrow{DA}$ is

(A) $5\overrightarrow{CA}$

(B) $2\overrightarrow{CA}$

(C) $3\overrightarrow{CA}$

(D) $8\overrightarrow{CA}$

Space for Rough Work

16. The direction cosines of two lines that are at right angles are l_1, m_1, n_1 and l_2, m_2, n_2, then the direction cosines of a line which is perpendicular to both these lines are

(A) $l_1 + kl_2, m_1 - km_2, n_1 + kn_2$

(B) $m_1n_2 - m_2n_1, n_1l_2 - n_2l_1, l_1m_2 - l_2m_1$

(C) $l_1 - l_2, m_1 - m_2, n_1 - n_2$

(D) $l_1 + l_2, m_1 + m_2, n_1 + n_2$

17. If $|\vec{a}| = 4$; $|\vec{b}| = 2$ and the angle between $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{6}$, then $|\vec{a} \times \vec{b}|$ is

(A) 3

(B) 4

(C) 16

(D) 9

18. If the vectors $\bar{a} = 3\bar{i} + 6\bar{j} + 2\bar{k}$ and $\bar{b}$ are collinear and $|\bar{b}| = 28$, then $\bar{b} =$

(A) $\pm 3 (2\bar{i} + 6\bar{j} + \bar{k})$

(B) $\pm 4 (3\bar{i} + 6\bar{j} + 2\bar{k})$

(C) $\pm 28 (3\bar{i} + 6\bar{j} + 2\bar{k})$

(D) $\pm 2 (3\bar{i} + 6\bar{j} + 2\bar{k})$

Space for Rough Work

19. For three vectors, $|\vec{a}| = |\vec{b}| = |\vec{c}|$, angle between each pair of these vectors is $\frac{\pi}{3}$ and

$|\vec{a} + \vec{b} + \vec{c}| = \sqrt{6}$, then $|\vec{a}|$ is

(A) 1

(B) $\sqrt{3}$

(C) – 1

(D) 2

20. The value of the limit $\lim\limits_{x \to 0} \frac{\log(1 + ax) - \log(1 - bx)}{x}$ is

(A) a – b

(B) a + b

(C) ab

(D) $\frac{a}{b}$

21. If the function $x = x(y)$ is defined as $x = e^{y+e^{y+e^{y+\ldots\infty}}}$ then $\frac{dy}{dx}$ is given by

(A) $1 + x$

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

(C) $\frac{1}{x} - 1$

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

Space for Rough Work

22. The value of the integral $\int e^{2x}\left(\frac{1+\sin 2x}{1+\cos 2x}\right)dx$ is

(A) $\frac{1}{2}e^{2x}\tan 2x + c$

(B) $\frac{1}{2}e^{2x}\tan x + c$

(C) $\frac{1}{2}e^{2x}\sin 2x + c$

(D) $\frac{1}{2}e^{2x}\cos 2x + c$

23. If $\int_{m}^{m+1} f(x)dx = m^2$, where $m \in \mathbb{Z}$, then $\int_{-1}^{3} f(x)dx$ is

(A) 54

(B) 16

(C) 6

(D) 36

Space for Rough Work

24. If $f(\theta) = \begin{vmatrix} \sec\theta & \cos\theta \\ \cos^2\theta & \cos^2\theta \end{vmatrix}$, then the value of the definite integral $\int_0^{\pi/2} f(\theta)d\theta$ is

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

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

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

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

25. The solution of $\frac{dy}{dx} = \frac{1}{y^2 + \sin y}$, $y \neq 0$, with an arbitrary constant c is

(A) $x = y^3 - \cos^2 y + c$

(B) $x = y - \cos y + c$

(C) $x = \frac{y^3}{3} - \cos y + c$

(D) $x = y^2 - \frac{\cos y}{3} + c$

Space for Rough Work

26. The differential equation governing the solution $ax^2 - by^2 = 16$ is $y\left(\frac{d^2y}{dx^2}\right) + \left(\frac{dy}{dx}\right)^2 =$

(A) $y\frac{dy}{dx}$

(B) $\left(\frac{1}{x}\right)\frac{dy}{dx}$

(C) $\left(\frac{y}{x}\right)\frac{dy}{dx}$

(D) $\left(\frac{x}{y}\right)\frac{dy}{dx}$

27. If $\frac{dy}{dx} = u^2$, where $u = 4x + y + 1$ then,

(A) $2\tan^{-1}\left(\frac{u}{2}\right) = x + c$

(B) $\tan^{-1}\left(\frac{u}{2}\right) = 2(x + c)$

(C) $y = 2\tan^{-1} x + c$

(D) $\frac{u^2}{2} = \tan^{-1} xy + c$

Space for Rough Work

28. The order and degree of the differential equation $\sqrt[3]{\frac{dy}{dx}\sqrt{\frac{d^3y}{dx^3}}} = 4$ is

(A) 2, 3

(B) 3, 6

(C) 3, 2

(D) 3, 1

29. If $y = (1234)e^{11x} + (5678)e^{-11x}$ then $\frac{d^2y}{dx^2}$ is equal to

(A) 1234y

(B) 5678y

(C) 121y

(D) 1331y

30. The differential equation that represents the family of lines $ax + by + c = 0$ is

(A) $\frac{dy}{dx} = 0$

(B) $x + y\frac{dy}{dx} + \frac{d^2y}{dx^2} = 0$

(C) $\frac{d^2y}{dx^2} = 0$

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

Space for Rough Work

31. If P(A) = x, P(B) = 2x, P(A ∩ B) = $\frac{1}{2}$, P ($\bar{A} \cap \bar{B}$) = $\frac{2}{3}$, then the value of x is

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

(B) $\frac{5}{36}$

(C) $\frac{6}{36}$

(D) $\frac{11}{36}$

32. A die is rolled 3 times, the probability of getting a number larger than the previous number each time is

(A) $\frac{5}{54}$

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

(C) $\frac{13}{216}$

(D) $\frac{23}{216}$

33. If Ramu and Raju can solve 80% and 60% respectively of the problems in a book, what is the probability that at least one of them will solve "the problem selected at random" from the book.

(A) 0.92

(B) 0.86

(C) 0.68

(D) 0.94

Space for Rough Work

34. The dual of the statement $p \vee (q \vee r) \equiv (p \vee q) \vee r$ is

(A) $p \wedge (q \vee r) \equiv (p \wedge q) \vee r$

(B) $p \wedge (q \wedge r) \equiv (p \wedge q) \wedge r$

(C) $p \vee (q \wedge r) \equiv (p \wedge q) \vee r$

(D) None of these

35. A function is defined as $f(x) = \frac{kx}{x+1}$, $x \neq -1$, then for what value of k is $f(f(x)) = x$

(A) -1

(B) 1

(C) $\sqrt{3}$

(D) $-\sqrt{2}$

36. The maximum value of $1 + 8 \sin^2\theta^2\cos^2\theta^2$ is

(A) 0

(B) -8

(C) 3

(D) 10

Space for Rough Work

37. The coefficient of x^4 in the expansion of $\dfrac{2x + 1 + 3x^2}{e^x}$ is

(A) $-\dfrac{36}{15}$

(B) $\dfrac{29}{24}$

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

(D) $-\dfrac{8}{5}$

38. A set S has 5 distinct elements. Then the number of distinct one-one functions that can be defined from S to S is

(A) 32

(B) 2^{25}

(C) 120

(D) 5^5

39. The digit in the units place of $1! + 2! + 3! + 4! + \ldots + n!$, where $n > 4$ is

(A) 1

(B) 2

(C) 3

(D) 4

Space for Rough Work

40. For $n \in N$, $6^n - 5n - 1$ is always divisible by

(A) 50

(B) 25

(C) 75

(D) 125

41. The quadratic equation whose roots are p and q where

$$p = \lim_{x \to 0} \frac{3 \sin x - 4 \sin^3 x}{x} \quad \text{and} \quad q = \lim_{x \to 0} \frac{2 \tan x}{1 - \tan^2 x} \text{ is}$$

(A) $x^2 + 5x + 6 = 0$

(B) $x^2 + 3x + 2 = 0$

(C) $x^2 - 5x + 6 = 0$

(D) $x^2 - 3x + 2 = 0$

42. If $(1 + i)^{100} = 2^{49} (x + iy)$, then $x^2 + y^2$ is equal to

(A) 0

(B) 32

(C) 16

(D) 4

Space for Rough Work

43. For the complex number i, $i^{4n} + i^{4n+1} + i^{4n+2} + i^{4n+3} + i^{4n+4} + i^{4n+6}$ is

(A) 16

(B) 4

(C) 1

(D) 0

44. In the expansion of $\frac{(2-x)(2+x)}{(1-x)(1+x)}$, $|x| < 1$, the term that is independent of x is

(A) 3

(B) 4

(C) 5

(D) 2

45. For three real numbers a, b, c with a ≠ 6; if $\begin{vmatrix} a & 2b & 2c \\ 3 & b & c \\ 4 & a & b \end{vmatrix} = 0$, then abc =

(A) a + b + c

(B) ab + b – c

(C) 0

(D) b^3

Space for Rough Work

46. The number of solutions of the system of equations

$2x + y - z = 7; x - 3y + 2z = 1; x + 4y - 3z = 5$ is

(A) 0

(B) 2

(C) 3

(D) 1

47. For non-zero numbers p, q, r, a, b, c, if $\begin{vmatrix} pa & qb & rc \\ qc & ra & pb \\ rb & pc & qa \end{vmatrix} = pqr \begin{vmatrix} a & b & c \\ c & a & b \\ b & c & a \end{vmatrix}$ then

(A) pqr = 1

(B) p + q + r = 1

(C) p + q + r = 0

(D) pqr = 0

48. Let $\begin{vmatrix} x & 2 & x \\ x^2 & x & 6 \\ x & x & 6 \end{vmatrix} = Ax^4 + Bx^3 + Cx^2 + Dx + E$, then the value of $9A - 4B + 3C + 5D + 6E$ is

(A) 36

(B) 38

(C) 35

(D) 37

Space for Rough Work

49. If $A = \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$, then the matrix A^{2014} is same as

(A) A

(B) – A

(C) I

(D) – I

50. If $A = \begin{vmatrix} -1 & 2 & 0 \\ 3 & 1 & 5 \\ -1 & 2 & -1 \end{vmatrix}$, then |adj(adjA)| is

(A) 1492

(B) 1592

(C) 1694

(D) 2401

51. The value of $\sec^2(\tan^{-1}2) + \text{cosec}^2(\cot^{-1}3)$ is

(A) 5

(B) 20

(C) 10

(D) 15

Space for Rough Work

52. Given that $\sin \alpha + \sin \beta = p$ and $\cos \alpha - \cos \beta = q$, then the value of $\cos(\alpha - \beta)$ is

(A) $\frac{p^2 - q^2}{p^2 + q^2}$

(B) $\frac{2pq}{p^2 + q^2}$

(C) $\frac{2pq}{p^2 - q^2}$

(D) $\frac{p^2 + q^2}{p^2 - q^2}$

53. The value of $\sqrt{3}$ cosec 20° – sec 20° is

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

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

(C) 2

(D) 4

54. If $x = \sin^2\theta + \cos^4\theta$, then for all values of θ, the interval x belongs to is

(A) $0 \leq x \leq 1$

(B) $1 \leq x \leq 2$

(C) $\frac{3}{4} \leq x \leq 1$

(D) $\frac{1}{4} \leq x \leq \frac{1}{2}$

Space for Rough Work

55. The equality $\cot^{-1}\alpha = \tan^{-1}\frac{1}{\alpha}$ holds good only when

(A) $\alpha = 0$

(B) $|\alpha| \leq 1$

(C) $\alpha < 0$

(D) $\alpha > 0$

56. The approximate value of $\tan^{-1}(1.001)$ is

(A) $\frac{\pi}{4} + 0.1$

(B) $\frac{\pi}{4} + 0.005$

(C) $\frac{\pi}{4} + 0.002$

(D) $\frac{\pi}{4} + 0.0005$

57. The roots of $x^2 - 2\sqrt{3}x + 2 = 0$ represent the lengths of two sides of a triangle and if the angle between these sides is 60°, then the perimeter of the triangle is

(A) $3 + 2\sqrt{6}$

(B) $2\sqrt{3} + 2\sqrt{6}$

(C) $2\sqrt{3} + \sqrt{6}$

(D) $3\sqrt{2} + 6$

Space for Rough Work

58. The area bounded by the ellipse $\frac{x^2}{175}+\frac{y^2}{343}=1$ is

(A) $150\sqrt{7}\pi$

(B) 115π

(C) 200π

(D) 245π

59. If $x - 2y - a = 0$ is a chord of the parabola $y^2 = 4ax$, then its length is given by

(A) 10a

(B) 20a

(C) 30a

(D) 40a

60. A pair of straight lines is given by $x^2(\sin^2\alpha - 1) + y^2\cos^2\alpha - yx \cos^2\alpha = 0$, the angle between them is given by

(A) π

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

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

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

Space for Rough Work

Space For Rough Work