GOVERNMENT OF KARNATAKA
KARNATAKA SCHOOL EXAMINATION AND ASSESSMENT BOARD

Model Question Paper - 4

II P.U.C: MATHEMATICS (35): 2026-27

Time: 3 hours **Max. Marks: 80**

Instructions:

1) *The question paper has five parts namely A, B, C, D and E. Answer all the parts.*
2) *PART A has 15 MCQ's ,5 Fill in the blanks of 1 mark each.*
3) *Use the graph sheet for question on linear programming in PART E.*
4) *For questions having figure/graph, alternate questions are given at the end of question paper in separate section for visually challenged students.*

PART A

I. Answer ALL the Multiple Choice Questions **15 × 1 = 15**

1. Let R be the relation in the set N given by R = {(a, b): a = b – 2, b > 6}.

Choose the correct answer.

(A) (2, 4) ∈R (B) (3, 8) ∈R (C) (6, 8) ∈R (D) (8, 6) ∈R

2. The graph of the function $y = \cos^{-1} x$ is the mirror image of the graph of the function y= cosx along the line

(A)x=0 (B)y=x (C)y=1 (D)y=0

3. The number of all possible matrices of order 3×3 with each entry 1 and 2 is

(A) 27 (B) 512 (C) 81 (D) 18

4. If $A$and $B$are square matrix of order 3 and $|A|=5$, $|B|=3$ then $|3AB|=$

(A) 405 (B) 45 (C) 135 (D) 675

5. If $x-y=\pi$, then $\frac{dy}{dx}=$

(A) 1 (B) -1 (C) $1+\pi$ (D) π

6. If $y = \log(\cos e^x)$, then $\frac{dy}{dx}=$

(A) $-e^x tane^x$ (B) $e^x tane^x$ (C)$-e^x cote^x$ (D)$-tane^x$

7. The maximum value of $3sinx + 4\,cosx$ is

(A) 25 (B) 5 (C)$\sqrt{5}$ (D) $\sqrt{7}$

8. The function $f(x) = tanx + x$

(A) always increases (B) always decreases

(C) constant (D) sometimes increases and sometimes decreases

9. **Statement 1:** $\int_{-1}^{1} x\,dx = 0$.

Statement 2: $\int_{-a}^{a} f(x)\,dx = 0,\ if$ f(x) is an odd function

(A) Statement 1 is true and Statement 2 is false.

(B) Statement 1 is true and Statement 2 is true, Statement 2 is correct explanation for Statement 1

(C) Statement 1 is true and Statement 2 is true, Statement 2 is not a correct explanation for Statement 1

(D) Statement 1 is false and Statement 2 is false

10. $\int\left(\frac{x^3 - x^2 + x - 1}{x - 1}\right)dx =$

(A) $x^2 + x + C$ (B) $\frac{x^3}{3} + x + C$ (C) $\frac{x^3}{3} - x + C$ (D) $\frac{x^3}{3} + \frac{x^2}{2} + x + C$

11. The value of λ for which the vectors $2\hat{\imath} - 3\hat{\jmath} + 4\hat{k}$ and $-4\hat{\imath} + \lambda\hat{\jmath} - 8\hat{k}$ are collinear is

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

12. The angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitudes $\sqrt{3}$ and 2 respectively and $\vec{a} \cdot \vec{b} = \sqrt{6}$ is

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$

13. Find the direction cosines of the line $\frac{x-5}{3} = \frac{y-2}{2} = \frac{z+4}{-8}$

(A) 3, 2, −8 (B) $\frac{3}{\sqrt{77}}, -\frac{2}{\sqrt{77}}, -\frac{8}{\sqrt{77}}$

(C) $\frac{5}{\sqrt{77}}, \frac{2}{\sqrt{77}}, -\frac{4}{\sqrt{77}}$ (D) $\frac{5}{\sqrt{45}}, \frac{2}{\sqrt{45}}, -\frac{4}{\sqrt{45}}$

14. If A and B are independent events with $P(A) = 0.3, P(B) = 0.4$ then $P(A and\ B)$

(A) 0.3 (B) 0.4 (C)0.12 (D)0.7

15. Let A and B be two given events such that $P(A) = 0.6$, $P(B) = 0.2$ and $P(A/B) = 0.5$, then $P(A \cap B) =$

(A) $\frac{1}{10}$ (B) $\frac{3}{10}$ (C) $\frac{5}{6}$ (D) $\frac{5}{36}$

II. Fill in the blanks by choosing the appropriate answer from those given in the Bracket (-1, 0, 1, 2, 4, 5) **5 × 1 = 5**

16. If $\boldsymbol{x - y = \pi}$ then, $\frac{dy}{dx}$ =____

17. The rate of change of the area of a unit circle with respect to its radius r is.... πcm^2

18. A differential equation of the form $\frac{dy}{dx}$= F (*x, y*) is said to be *homogenous* if F(*x, y*) is a homogenous function of degree_____

19. If $(2\vec{a} - 3\vec{b}) \times (3\vec{a} - 2\vec{b}) = \lambda(\vec{a} \times \vec{b})$, then the value of λ is _____

20. If A and B are any two events such that P(A) + P(B) – P(A and B) =P(B), then P(B/A) is__

PART B

III. Answer Any SIX Questions: **6 × 2 = 12**

21. Show that $\sin^{-1}\left(2x\sqrt{1-x^2}\right) = 2\cos^{-1}(x)$, $\frac{1}{\sqrt{2}} \le x \le 1$.

22. Find values of k if area of triangle is 3 sq.units and vertices are (1, 3), (0, 0) and (k, 0).

23. Differentiate $(\log x)^{\cos x}$ with respect to x.

24. Find two numbers whose product is 100 and whose sum is minimum.

25. Evaluate $\int_0^1 \frac{x}{1+x^2}\,dx$

26. Find the order and degree of the differential equation $\frac{d^4y}{dx^4} - \sin\left(\frac{d^3y}{dx^3}\right) = 0$.

27. If $\vec{a}$ is a unit vector such that $(\vec{x} - \vec{a}).(\vec{x} + \vec{a}) = 8$, find $|\vec{x}|$.

28. Find the angle between the pair of lines $\vec{r} = 2\hat{i} + \hat{j} - 2\hat{k} + \lambda(\hat{i} - \hat{j} - 2\hat{k})$ and $\vec{r} = 2\hat{i} - \hat{j} - 56\hat{k} + \mu(3\hat{i} - 5\hat{j} - 4\hat{k})$.

29. A die is thrown twice and the sum of the numbers appearing is observed to be 6. What is the conditional probability that the number 4 has appeared at least once?

PART C

IV. Answer Any SIX Questions: **6 × 3 = 18**

30. Show that the relation R in the set $A = \{1, 2, 3, 4, 5\}$ given by $R = \{(a, b): |a - b| \text{ is even}\}$, is an equivalence relation.

31. Prove that $\cos^{-1}\frac{4}{5} + \cos^{-1}\frac{12}{13} = \cos^{-1}\frac{33}{65}$

32. For the matrix $A = \begin{bmatrix} 1 & 5 \\ 6 & 7 \end{bmatrix}$, verify that

(i) $A + A'$ is a symmetric matrix. (ii) $A - A'$ is a skew- symmetric matrix.

33. If $x = a\left(\cos t + \log\tan\frac{t}{2}\right)$, $y = a\sin t$ prove that $\frac{dy}{dx} = \tan t$.

34. The length x of a rectangle is decreasing at the rate of 5cm/min and the width y is increasing at the rate of 4cm/min. When $x = 8$ cm and $y = 6$ cm, find the rates of change of the area of the rectangle.

35. Find $\int \frac{dx}{(x+1)(x+2)}$

36. If the vertices A, B and C of a triangle are $(1, 2, 3)$, $(-1, 0, 0)$ and $(0, 1, 2)$ respectively, then find the $\angle ABC$.

37. Find the distance between the lines $\frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}$ and $\frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1}$

38. There are three coins. one is a two headed coin, another is a biased coin that comes up head 75% of the time and third is an unbiased coin. one of the three coins is chosen at random and tossed, it shows head, what is the probability that it was the two headed coin?

PART D

V. Answer Any FOUR Questions: **5 × 4 = 20**

39. Show that the function $f : R_* \to R_*$ defined by $f(x) = \frac{1}{x}$ is one-one and onto, where R_* is the set of all non-zero real numbers.

40. If $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix}$, then show that $A^3 - 23\text{A} - 40\text{I} = O$.

41. Use the product $\begin{pmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{pmatrix}\begin{pmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & -2 \end{pmatrix}$ to solve the system of equations

$x - y + 2z = 1,\ 2y - 3z = 1,\ 3x - 2y + 4z = 9.$

42. If $y = 3\cos(logx) + 4\sin(logx)$ prove that $x^2y_2 + xy_1 + y = 0$.

43. Find the integral of $\frac{1}{\sqrt{x^2+a^2}}$ w.r.t x and hence evaluate $\int \frac{1}{\sqrt{x^2+2x+4}}dx$.

44. Using the method of integration, find the area enclosed by the ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$.

45. Find the general solution of $cos^2x\frac{dy}{dx} + y = \tan x \left(0 \le \text{x} \le \frac{\pi}{2}\right)$

PART E

VI. Answer The Following Questions:

46. Prove that $\int_a^b f(x)dx = \int_a^c f(x)dx + \int_c^b f(x)dx$ and hence Evaluate $\int_{-5}^{5}|x+2|\,d$ **6M**

OR

Solve the following linear programming problem graphically:

Maximize $z = 3x + 2y$ subject to $x + 2y \le 10, 3x + y \le 15, x, y \ge 0$

47. Find the relationship be a and b so that the function f is defined by

$f(x) = \begin{cases} ax + 1, & if x \le 3 \\ bx + 3, & if x > 3 \end{cases}$ is continuous at x = 3 **4M**

OR

Show that the matrix A = $\begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix}$ satisfies the equation A^2-4A+I =O, where I is 2 x 2 identity matrix and 2 x 2 zero matrix. Using this equation, find A^{-1}