GOVERNMENT OF KARNATAKA

KARNATAKA SCHOOL EXAMINATION AND ASSESSMENT BOARD

Model Question Paper - 3

II P.U.C: MATHEMATICS (35): 2025-26

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 **$15 \times 1 = 15$**

1. A function $f: R \to R$ defined by $f(x) = 2x + 6$ is a bijective mapping then $f^{-1}(x)$ is given by

A) $\frac{x}{2} - 3$ B) $2x + 6$ C) $x - 3$ D) $6x + 2$.

2. The principal value branch of $\sec^{-1}x$.

A) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right) - \{0\}$ B) $(0, \pi) - \{\frac{\pi}{2}\}$ C) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right] - \{0\}$ D) $[0, \pi] - \left\{\frac{\pi}{2}\right\}$.

3. If a matrix has 13 elements, then total number the possible different orders matrices

A) 1 B) 2 C) 3 D) 4.

4. If $\begin{vmatrix} 3 & x \\ x & 1 \end{vmatrix} = \begin{vmatrix} 3 & 2 \\ 4 & 1 \end{vmatrix}$ then x is equal to

A) 2 B) 4 C) 8 D) $\pm 2\sqrt{2}$.

5. The derivative of $f(x) = |x - 3|$ at x = 3 is

A) 0 B) 1 C) -1 D) not existing

6. If $y = \sin^{-1} x + \sin^{-1} \sqrt{1 - x^2}, 0 < x < 1$ then $\frac{dy}{dx} =$

A) $\frac{1}{\sqrt{1-x^2}}$ B) -1 C) 0 D) $\frac{2}{\sqrt{1-x^2}}$.

7. The minimum value of $|x|$ in R is......

A) 0 B) 1 C) 2 D) does not exist.

8. The rate of change of the area of a circle with respect to its radius r when r = 4 cm is........πcm^2/cm.

A) 10 B) 12 C) 8 D) 11

9. $\int \frac{1-x}{\sqrt{x}} dx$ is

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

10. $\int_0^{\pi}(\sin^2\frac{x}{2}-\cos^2\frac{x}{2})dx =$

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

11. In vector addition, which of the following is not true:

A) $\overrightarrow{AB}+\overrightarrow{BC}+\overrightarrow{CA}=\vec{0}$ B) $\overrightarrow{AB}+\overrightarrow{BC}-\overrightarrow{AC}=\vec{0}$

C) $\overrightarrow{AB}+\overrightarrow{BC}-\overrightarrow{CA}=\vec{0}$ D) $\overrightarrow{AB}-\overrightarrow{CB}+\overrightarrow{CA}=\vec{0}$

12. **Assertion (A):** The two vectors $\vec{a} = 2\hat{\imath}-\hat{\jmath}+2\hat{k}$ and $\vec{b} = -6\hat{\imath}+3\hat{\jmath}-6\hat{k}$ are collinear vectors.

Reason (R): If two vectors $\vec{a}$ and $\vec{b}$ are collinear, then $\vec{a} = \lambda\vec{b}$, where $\lambda \epsilon\, R$.

A) A is false and R is true B) A is false and R is false

C) A is true and R is false D) A is true and R is true.

13. If a line makes $\frac{\pi}{2}, \frac{3\pi}{4}, \frac{\pi}{4}$ with x, y, z axes respectively, then its direction cosines are

A) $0, -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$ B) $0, -\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}$ C) $1, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$ D) $0, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$

14. Probability of solving a specific problem independently by A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively. If both try to solve the problem then the probability that exactly one of them solves the problem is

A) $\frac{1}{6}$ B) $\frac{2}{3}$ C) $\frac{1}{3}$ D) $\frac{1}{2}$

15. If $P(E) = 0.6, P(F) = 0.3$ *and* $P(E \cap F) = 0.2$ then $P(F|E)$ *is*

A) 0 B) $\frac{2}{3}$ C) $\frac{1}{3}$ D) $\frac{3}{2}$.

II. Fill in the blanks by choosing the appropriate answer from those given in the bracket ($-2, -1, 0, 1, 2, 3$) **5 × 1 = 5**

16. If $y = 3\,cosx - 5\,sinx$, then $\frac{d^2y}{dx^2}$ + y = __________

17. The number of points of local maxima and local minima of the function *f* given by $f(x) = x^3 - 3x + 3$ *is* ______

18. The number of arbitrary constants in the general solution of a differential equation of third order are ______

19. The projection of the vector $\vec{a} = \hat{\imath} - 2\hat{\jmath} + 2\hat{k}$ on y-axis is __________

20. If A and B are two events such that A is a sub set of B and P(A) ≠ 0, then P(B/A) = ____

PART B

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

21. Evaluate $cos^{-1}\left[cos\frac{7\pi}{6}\right]$

22. If the area of the triangle with vertices (2, – 6), (5, 4) and (k, 4) is 35 square units. Find the values of *k* using determinants.

23. Find $\frac{dy}{dx}$, if $\sin^2 x+\cos^2 y=1$.

24. Prove that the function f given by $f(x)=x^2e^{-x}$ is increasing in $(0,2)$.

25. Find $\int \tan^2(2x-3)dx$

26. Find the equation of the curve passing through the point (1, 1) whose differential equation is $xdy=\left(2x^2+1\right)dx\ (x\neq 0)$

27. Find the area of the triangle whose adjacent sides are determined by the vectors $\vec{a}=-2\hat{i}-5\hat{k}$ and $\vec{b}=\hat{i}-2\hat{j}-\hat{k}$

28. Find the value of k, so that the lines $\frac{x-1}{-3}=\frac{y-2}{2k}=\frac{z-3}{2}$ and $\frac{x-1}{3k}=\frac{y-1}{1}=\frac{z-6}{-5}$ are at right angles.

29. An urn contains 10 black and 5 white balls. Two balls are drawn from the urn one after the other without replacement. What is the probability that both drawn balls are black?

PART C

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

30. Check whether the relation R in **R** the set of real numbers defined as $R=\left\{(a,b): a\le b^3\right\}$ is reflexive, symmetric and transitive.

31. Write $tan^{-1}\left(\frac{cos\,x-sin\,x}{cos\,x+sin\,x}\right), -\frac{\pi}{4}<x<\frac{3\pi}{4}$ in simplest form

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. Find $\frac{dy}{dx}$, if $x=\cos\theta-\cos 2\theta,\ y=\sin\theta-\sin 2\theta$.

34. Find the absolute maximum and minimum values of a function $f(x)=2x^3-15x^2+36x+1$ on the interval $[1,5]$.

35. Find $\int \frac{(x-3)e^x}{(x-1)^3}dx$

36. Show that the position vector of the point P, which divides the line joining the points A and B having the position vectors $\vec{a}$ and $\vec{b}$ internally in the ratio m:n is $\frac{m\vec{b}+n\vec{a}}{m+n}$.

37. Find the distance between the lines l_1 & l_2 whose vector equations are $\vec{r}=\vec{i}+\vec{j}+\lambda\left(2\vec{i}-\vec{j}+\vec{k}\right)$ & $\vec{r}=2\vec{i}+\vec{j}-\vec{k}+\mu\left(3\vec{i}-5\vec{j}+2\vec{k}\right)$.

38. Given three identical boxes I, II and III, each containing two coins. In box I, both are gold coins, in box II, both are silver coins and, in the box III, there is one gold and one silver coin. A person chooses a box at random and takes out a coin. If the coin is of gold, what is the probability that the other coin in the box is also of gold?

PART D

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

39. If $f : R \to R$ is defined by $f(x) = 1 + x^2$, then show that f is neither 1-1 nor onto.

40. For the matrices $A = \begin{bmatrix} -2 \\ 4 \\ 5 \end{bmatrix}, B = \begin{bmatrix} 1 & 3 & -6 \end{bmatrix}$, verify that $(AB)' = B'A'$.

41. Solve the system of linear equations by matrix method $2x + 3y + 3z = 5,\ x - 2y + z = -4$ and $3x - y - 2z = 3$

42. If $y = \left(\tan^{-1} x\right)^2$, show that $(1+x^2)^2 y_2 + 2x(1+x^2)y_1 = 2.$

43. Integrate $\frac{1}{x^2 + a^2}$ with respect to x and hence find $\int \frac{dx}{x^2 + 2x + 10}$

44. Find the area bounded by the curve $y = \sin x$ between $x = 0$ & $x = 2\pi$.

45. Find the general solution of the differential equation $x\frac{dy}{dx} + 2y = x^2 \log x$

PART E

VI. Answer The Following Questions:

46. Prove that $\int_a^b f(x)dx = \int_a^b f(a+b-x)dx$ and evaluate $\int_{\pi/6}^{\pi/3} \frac{dx}{1+\sqrt{\tan x}}$. **6M**

OR

Minimize and Maximize Z = $3x + 9y$ subject to the constraints: $x + 3y \le 60$, $x + y \ge 10$ and $x \le y$ and $x \ge 0,\ y \ge 0$.

47. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, show that $A^2 - 5A + 7I = 0$ where I is 2 x 2 identity matrix and O is 2 x 2 zero matrix and hence find A^{-1}. **4M**

OR

Find the value of k if $f(x) = \begin{cases} kx^2, & if\ x \le 2 \\ 3\ , & if\ x > 2 \end{cases}$ is continuous at $x = 2$.