GOVERNMENT OF KARNATAKA
KARNATAKA SCHOOL EXAMINATION AND ASSESSMENT BOARD

Model Question Paper - 5

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 f: R→ R be defined by $f(x) = x^3$, x ∈R. Then

(A) f is one-one but not onto (B) f is one-one and onto

(C) f is many-one onto (D) f is neither one-one nor onto

2. **Statement 1**: $sin^{-1}\left(sin\left(\frac{2\pi}{3}\right)\right)=\frac{2\pi}{3}$

Statement 2: $sin^{-1}\left(sin(\theta)\right)=\theta, if\ \ \theta\in\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$

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 false and Statement 2 is true

D) Statement 1 is false and Statement 2 is false

3. If $A = \begin{bmatrix} 3 & x \\ y & 0 \end{bmatrix}$ and $A = A^T$, then

A) x = 0, y = 3 B) x + y = 3 C) x = y D) x = – y

4. Which of the following is correct

(A) Determinant is a square matrix
(B) Determinant is a number associated to a matrix.
(C) Determinant is a number associated to a square matrix.
(D) Determinant is just an arrangement of numbers.

5. If $y = \log_7(logx)$, then $\frac{dy}{dx} =$

A) $\frac{1}{xlog7logx}$ B) $\frac{1}{xlogx}$ C) $\frac{log7}{xlogx}$ D) $\frac{log7}{x}$

6. The function $f(x) = |x - a|$ is

A) continuous and differentiable at $x = a$

B) continuous but not differentiable at $x = a$

C) not continuous but differentiable at $x = a$

D) not continuous and not differentiable at $x = a$

7. The radius of circle is increasing at the rate of 0.7 cm/sec, then the rate of increase of its circumference is _____ π cm/sec

A)2 B)1.4 C)0.7 D)4.9

8. The function f(x) = $x^5 - 5x^4 + 5x^3 - 1$ has

A) 1 critical point B) 2 critical points

C) 3 critical points D) 4 critical points

9. $\int e^x(sinx - cosx)dx =$

A) $e^x sinx + c$ B) $e^x cosx + c$ C) $-e^x sinx + c$ D) $-e^x cosx + c$

10. $\int_0^4 \frac{dx}{16 + x^2} =$

A) $\frac{\pi}{2}$ B) $\frac{\pi}{4}$ C) $\frac{\pi}{8}$ D) $\frac{\pi}{16}$

11. The value of x for which $x(\hat{\imath} + \hat{\jmath} + \hat{k})$ is a unit vector.

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

12. If θ is the angle between any two vectors $\vec{a}$ and $\vec{b}$, then $|\vec{a} \cdot \vec{b}| = |\vec{a} \times \vec{b}|$ when θ is equal to

A) 0 B) $\frac{\pi}{4}$ C) $\frac{\pi}{2}$ D) π

13. If a line makes an angles α, β, γ with the positive direction of the co-ordinate axes. Then cos2α + cos2β + cos2γ

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

14. If $2P(A) = P(B) = \frac{5}{13}$ *and* $P(A|B) = \frac{2}{5}$, then $P(A \cap B)$ is

A) $\frac{5}{26}$ B) $\frac{15}{26}$ C) $\frac{19}{26}$ D) $\frac{2}{13}$.

15. If A and B are two events such that A ⊂B and P(B) ≠0, then which of the following is correct?

A) $P(B/A) = \frac{P(B)}{P(A)}$ B) P(A∩B) < P(A) C) P(A | B) = P(A) D) $P(B/A) = 1$

II. Fill in the blanks by choosing the appropriate answer from those given in the bracket (25, −1, 1, 0, 10, 15) **5 × 1 = 5**

16. Left hand derivative of f(x) = $|x - 7|$ at x = 7 is _____

17. If $x + y = 10$, then the maximum value of xy_____

18. The order of the differential equation $\frac{dy}{dx} = e^{2x}$ is _____

19. The value of $\hat{\imath} \cdot (\hat{\jmath} + \hat{k}) + \hat{\jmath} \cdot (\hat{\imath} + \hat{k}) + \hat{k} \cdot (\hat{\imath} + \hat{\jmath})$ is _____

20. If $P(A) = \frac{3}{5}, P(B) = \frac{1}{3}$ and A and B are independent events then $P(A \cap B) = \frac{3}{k}$,then k=___

PART B

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

21. Prove that $2\sin^{-1}\frac{3}{5} = \tan^{-1}\frac{24}{7}$

22. If the area of the triangle with vertices $(-2,0),(0,4)$ and $(0,k)$ is 4 square units. Find the values of k using determinants.

23. If $\sqrt{x}+\sqrt{y}=10$, show that $\frac{dy}{dx}+\sqrt{\frac{y}{x}}=0$.

24. Find the interval in which the function f given by $f(x)=2x^2-3x$ is increasing

25. Find $\int \frac{\sin^2 x}{1+\cos x}dx$

26. Find the equation of a curve passing through the point (-2, 3), given that the slope of the tangent to the curve at any point (x, y) is $\frac{2x}{y^2}$.

27. Find the position vector of a point R which divides the line joining two points P and Q whose position vectors are $\vec{i}+2\vec{j}-\vec{k}$ *and* $-\vec{i}+\vec{j}+\vec{k}$ respectively, in the ratio 2 : 1 internally.

28. Find the direction cosines of the line which makes equal angles with coordinate axis

29. If A and B are two events such that $P(A)=\frac{1}{4}$ *and* $P(B)=\frac{1}{2}$. Then $P(A\cap B)=\frac{1}{8}$ then Find P(not A and not B)

PART C

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

30. Determine whether the Relation R in the set A= {1, 2, 3, 4, 5, 6} as $R=\{(x,y): y \text{ is divisible by } x\}$ is reflexive, symmetric & transitive

31. Solve: $\tan^{-1}\left(\frac{1-x}{1+x}\right)=\frac{1}{2}\tan^{-1}x \quad (x>0)$

32. If A and B are invertible matrices of the same order, then $(AB)^{-1}=B^{-1}A^{-1}$

33. Differentiate $\sin^2 x$ with respect to $e^{\cos x}$

34. A balloon, which always remains spherical on inflation, is being inflated by pumping in 900 cubic centimeters of gas per second. Find the rate at which the radius of the balloon increases when the radius is 15 cm.

35. Find $\int x^2 \log x dx$

36. The scalar product of the vector $\hat{i}+\hat{j}+\hat{k}$ with a unit vector along the sum of vectors $2\hat{i}+4\hat{j}-5\hat{k}$ & $\lambda\hat{i}+2\hat{j}+3\hat{k}$ is equal to one. Find the value of λ

37. Find the distance between the lines $\vec{r} = \hat{\imath} + 2\hat{\jmath} + \hat{k} + \lambda(\hat{\imath} - \hat{\jmath} + \hat{k})$ and $\vec{r} = 2\hat{\imath} - \hat{\jmath} - \hat{k} + \mu(2\hat{\imath} + 3\hat{\jmath} + \hat{k})$

38. Probability that a person speaks truth is $\frac{4}{5}$, A coin is tossed a person reports that head appears. Find the probability that it is actually head.

PART D

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

39. Let $A = R - \{3\}$ and $B = R - \{1\}$. Consider the function $f : A \to B$ defined by $f(x) = \left(\frac{x-2}{x-3}\right)$. Is f one-one and onto? Justify your answer

40. If $A = \begin{bmatrix} 3 & \sqrt{3} & 2 \\ 4 & 2 & 0 \end{bmatrix}; B = \begin{bmatrix} 2 & -1 & 2 \\ 1 & 2 & 4 \end{bmatrix}$ then verify $(A+B)^1 = A^1 + B^1$

41. Solve the system of linear equations by matrix method $3x - 2y + 3z = 8$, $2x + y - z = 1$ and $4x - 3y + 2z = 4$

42. If $y = Ae^{mx} + Be^{nx}$, prove that $\frac{d^2y}{dx^2} - (m+n)\frac{dy}{dx} + (mn)y = 0.$

43. *Find* the integral of $\frac{1}{\sqrt{x^2+a^2}}$ with respect to x and hence evaluate $\int \frac{dx}{\sqrt{1+4x^2}}$

44. Using the method of integration, find the area lying in the first quadrant and bounded by the circle $x^2 + y^2 = 4$ and the lines $x = 0$ and $x = 2$.

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

PART E

VI. Answer The Following Questions:

46. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate $\int_0^{\pi/2} \frac{\sin^{3/2} x}{\sin^{3/2} x + \cos^{3/2} x} dx$ **6M**

OR

Solve the following linear programming problem graphically:

Maximize Z=4x+y, subject to constraints $x + y \le 50, 3x + y \le 90, x \ge 0, y \ge 0$

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 values of a and b such that $f(x) = \begin{cases} 5, & if\ x \le 2 \\ ax + b, & if\ 2 < x < 10 \\ 21, & if\ x \ge 10 \end{cases}$

is a continuous function