KENDRIYA VIDYALAYA SANGATHAN

ERNAKULAM REGION

PRE-BOARD-1 2026-27

CLASS XII - MATHEMATICS (Code 041)

Time allowed: 3 hours **Maximum marks: 80**

This Question paper contains - five sections A, B, C, D and E. Each section is compulsory.

However, there are internal choices in some questions.

2. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.

3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.

4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.

5. Section D has 4 Long Answer (LA)-type questions of 5 marks each.

6. Section E has 3 source based/case based/passage based/integrated units of assessment of 4 marks each with sub-parts.

Section A (1 mark each)

Q1 to Q18 are multiple choice questions. Select the correct option.

1. Let A = {1, 2, 3} and R = {(1, 1), (2, 2), (1, 2), (2, 1)} be a relation on A. Then R is

(A) reflexive only (B) an equivalence relation (C) symmetric and transitive but not reflexive (D) reflexive and symmetric but not transitive

2. The principal value of $cot^{-1}(\frac{-1}{\sqrt{3}})$ is

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

3.] If $A=\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$ then A^{2025} equals

(A) I (B) A (C) −A (D) −I

4. The number of all possible matrices of order 2 × 3 with each entry 0 or 1 is

(A) 16 (B) 32 (C) 64 (D) 128

5. If A is a square matrix of order 3 and |A| = 4, then |adj A| is

(A) 4 (B) 8 (C) 12 (D) 16

6. If $\begin{bmatrix} x & 2 \\ 18 & x \end{bmatrix} = \begin{bmatrix} 6 & 2 \\ 18 & 6 \end{bmatrix}$, then x is

(A) 6 (B) ±6 (C) −6 (D) 0

7.If A=$\begin{bmatrix} 1 & 2 & 3 \\ -4 & 3 & 5 \end{bmatrix}$ and B=$\begin{bmatrix} 4 & 3 \\ -1 & 2 \\ 0 & 5 \end{bmatrix}$,then correct statement is

A)Only AB is defined B) Only BA is defined C)AB and BA ,both are defined D) AB and BA ,both are not defined

8. The area of the triangle with vertices (−3, 0), (3, 0) and (0, k) is 9 square units. Then k is

(A) ±3 (B) 3 only (C) 9 (D) ±9

9. The function f(x) = kx + 1 for x ≤ 5

= 3x − 5 for x > 5 is continuous at x = 5. Then k is

(A) $\frac{5}{9}$(B) 9 (C) 1 (D) $\frac{9}{5}$

10. If x = at² and y = 2at, then $\frac{dy}{dx}$ is

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

11. The rate of change of the area of a circle with respect to its radius r when r = 5 cm is

(A) 25π cm²/cm (B) 5π cm²/cm (C) 10π cm²/cm (D) 100π cm²/cm

12. ∫ eˣ (sin x + cos x) dx equals

(A) eˣ cos x + C (B) eˣ sin x + C (C) eˣ (sin x − cos x) + C (D) −eˣ sin x + C

13. The value of $\int \frac{dx}{2^x+2^{-x}}$ is equal to

(A) $tan^{-1}(2^x) + C$ (B) $tan^{-1}(2^{-x}) + C$ (C) $\frac{tan^{-1}(2^x)}{log 2}$ (D)(log2)$tan^{-1}(2^x)$ +C

14. If |a| = √3, |b| = 2 and a · b = √6, then the angle between a and b is

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

15. The projection of the vector a = i + 2j + 3k on the vector b = 2i + j + 2k is

(A) $\frac{10}{9}$ (B)$\frac{10}{3}$ (C) 10 (D)$\frac{3}{10}$

16. The direction cosines of the line $\frac{x-1}{2} = \frac{1-y}{3} = \frac{z-2}{6}$are

(A) $\frac{2}{7}, \frac{3}{7}, \frac{1}{6}$ (B) $\frac{1}{2}, \frac{1}{3}, \frac{1}{6}$ (C) $\frac{2}{\sqrt{11}}, \frac{3}{\sqrt{11}}$ (D) $\frac{2}{7}, -\frac{3}{7}, \frac{6}{7}$

17. A linear programming problem deals with the optimization of a/an

A)logarithmic function B)linear function C)Quadratic function D)exponential function

18. The number of corner pointsof the feasible region determined by the constraints $x \geq 0, y \geq 0$,

$x+y \geq 4$ is

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

Q19 and Q20 are Assertion-Reason questions. Choose the correct option: (A) Both A and R are true and R is the correct explanation of A. (B) Both A and R are true but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.

19. Assertion (A): $\sin^{-1}(\sin 2\pi/3) = \pi/3$.

Reason (R): The principal value branch of $\sin^{-1} x$ has range $[-\pi/2, \pi/2]$.

20. Assertion (A): A line can have direction cosines $\frac{1}{2}, \frac{1}{2}, \frac{1}{2}$

.Reason (R): If l, m, n are the direction cosines of a line, then $l^2 + m^2 + n^2 = 1$.

Section B (2 marks each)

21. Construct a 2 × 2 matrix A = $[a_{ij}]$ whose elements are given by $a_{ij} = \frac{(i+2j)^2}{2}$

OR

For two matrices P=$\begin{bmatrix} 2 & 0 & 0 \\ 0 & 1 & 2 \end{bmatrix}$ and Q=$\begin{bmatrix} 1 & 0 \\ 0 & 2 \\ 1 & 0 \end{bmatrix}$,find PQ and QP whichever is defined

22. Find $\frac{dy}{dx}$ if $y = \cos(\sqrt{x}) + e^{3x}$.

OR If $x=sin^3t, y=cos^3t$,find $\frac{d^2y}{dx^2}$

23. If $y = 5\cos x - 3\sin x$, prove that $\frac{d^2y}{dx^2} + y = 0$.

24. A drone flies in a straight line from the point P(1, 2, 3) to the point Q(3, −1, 9). Find the unit vector in the direction of its displacement PQ.

25. Find the value of λ for which the vectors $a = 2i + \lambda j + k$ and $b = i - 2j + 3k$ are perpendicular.

Section C (3 marks each)

26. Write $\tan^{-1}[\frac{\sqrt{1+x^2}-1}{x}$ $x \neq 0$, in the simplest form.

OR

Differentiate $\frac{5^x}{x^5}$ w.r.t x

27. Differentiate x^{sinx} with respect to x, for x > 0.

28. Sand is poured at the rate of 12 cm³/s on level ground and forms a conical heap whose height is always equal to its base radius. Find the rate at which the height of the heap is increasing when the height is 4 cm.

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

OR $\int \frac{2x}{(x^2+1)(x^2+2)}$dx

30. Two straight pipes in a model run along the lines r = (2i − j + 3k) + λ(i + j) and r = (i + 4j − k) + μ(j + k). Find the angle between the pipes.

31. Solve the linear programming problem graphically

Maximize Z=4x+y

Subject to the constraints : x+y$\leq 50, 3x + y \leq 50$

$x \geq 0, y \geq 0$

Section D (5 marks each)

32. Evaluate $\int_0^{\frac{\pi}{4}} \log(1 + tanx)\, dx$ dx.

33. A garden bed is bounded by the curved edge y² = 4x and the straight path y = x (units in metres). Using integration, find the area of the garden bed.

34. Find the particular solution of the differential equation $\frac{dy}{dx} - \frac{y}{x}$+ cosec($\frac{y}{x}$) = 0,

given that y = 0 when x = 1.

OR

Find the general solution of the differential equation $\frac{dy}{dx} - y = cosx$

35. Find the shortest distance between the lines r = (i + 2j + k) + λ(i − j + k) and r = (2i − j − k) + μ(2i + j + 2k).

OR

Find the distance between the lines r = (i + j) + λ(i + 2j + 2k) and r = (4i + j) + μ(i + 2j + 2k).

Section E (Case-based questions, 4 marks each)

36. Monica and Sanya are playingiudo.While rolling the dice,Monica observed that the possible outcomes of the throw belong to the set {1,2,3,4,5,6}

Let A be the set of players while B be the set of all possible outcomes

A={M,S} ,B={1,2,3,4,5,6}

(i)Let R:B→ B be defined by R={x,y): y is divisible by x}.What type of relation isR?

(ii) What is the number of functions from A to B

(iii)Let R be the relation on B defined by R={(1,1),(2,2),(3,3) ,(3,1),(4,4),(5,5)}.What type of relation is R ?

OR

(iii)Let R:B→ B be defined byR={(1,1),(2,2),(3,3),(4,4),(5,5),(6,6)}.

What type of relation is R?

37. A school shop sells pens, notebooks and erasers. Let the price of a pen, a notebook and an eraser be ₹x, ₹y and ₹z respectively. Three bundles were sold as follows:

- Bundle 1: 1 pen, 1 notebook and 1 eraser for ₹40
- Bundle 2: 2 pens, 1 notebook and 3 erasers for ₹60
- Bundle 3: 1 pen, 2 notebooks and 1 eraser for ₹65

(i) Write the situation as a matrix equation AX = B.

(ii) Find |A|. Does the system have a unique solution?

(iii) Find $A^2 - 8I$

OR

Given adj A = $\begin{bmatrix} -5 & 1 & 2 \\ 1 & 0 & -1 \\ 3 & -1 & -1 \end{bmatrix}$ find A^{-1} and hence the price of each item.

38. A packaging company makes open boxes from square tin sheets of side 18 cm. Equal squares of side x cm are cut from each corner and the sides are folded up to form an open box of volume V cm^3.

(i) Express V in terms of x. and find $\frac{dV}{dx}$)

(iii) Find $\frac{dV}{dx}$) and find the value of x for which the volume is maximum, verify that it is a maximum, and find the maximum volume.