Kendriya Vidyalaya Sangathan Bhopal Region

PRE-BOARD QUESTION PAPER (2024 - 25)

CLASS- XII

SUBJECT: Mathematics (041)

Time: 3 Hours | Maximum Marks: 80

General Instructions:

Read the following instructions very carefully and strictly follow them:

(i) This Question paper contains 38 questions. All questions are compulsory.

(ii) This Question paper is divided into five Sections - A, B, C, D and E.

(iii) In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) and Questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.

(iv) In Section B, Questions no. 21 to 25 are Very Short Answer (VSA)-type questions, carrying 2 marks each.

(v) In Section C, Questions no. 26 to 31 are Short Answer (SA)-type questions, carrying 3 marks each.

(vi) In Section D, Questions no. 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.

(vii) In Section E, Questions no. 36 to 38 are Case study-based questions, carrying 4 marks each.

(viii) There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and one subpart each in 2 questions of Section E.

(ix) Use of calculators is not allowed.

SECTION –A $[1\times 20 = 20]$	
Q.1.	If A and B are two square matrices such that $B = -A^{-1}BA$, then $(A+B)^2 =$ (a) 0 (b) A^2+B^2 (c) $A^2+2AB+B^2$ (d) $A+B$
Q.2.	For any 2×2 matrix A, if $A(adj.\ A) = \begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$, then $\vert A\vert =$ (a) 0 (b)10 (c) 20 (d) 100
Q.3.	The function $f(x) = x+\cos x$ is (a) Always increasing (b) Always decreasing (c) Increasing for certain range of x (d) None of these
Q.4.	If A and B are square matrices of order 3 such that $\vert A\vert = -1$, $\vert B\vert = 3$, then $\vert 3AB\vert =$ (a) -9 (b) -81 (c) -27 (d) 81

Q.5. The solution of differential equation $\frac{dy}{dx} + \sin^2 y = 0$ is

(a) $y + 2\cos y = c$ (b) $y - 2\sin y = c$

(c) $x = \cot y + c$ (d) $y = \cot x + c$

Q.6. If $p\lambda^4 + q\lambda^3 + r\lambda^2 + s\lambda + t = \begin{vmatrix} \lambda^2 + 3\lambda & \lambda - 1 & \lambda + 3 \\ \lambda + 1 & 2 - \lambda & \lambda - 4 \\ \lambda - 3 & \lambda + 4 & 3\lambda \end{vmatrix}$, the value of t is

(a) 16 (b) 18 (c) 17 (d) 19

Q.7. If A = $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is a skew symmetric matrix then

(a) B = - c (b) b = c (c) a = d (d) None of these

Q.8. If *A* and *B* are two events such that $A \subseteq B$, then $P\left(\frac{B}{A}\right) =$

(a) 0 (b) 1 (c) 1/2 (d) 1/3

Q.9. If **a** has magnitude 5 and points north-east and vector **b** has magnitude 5 and points north-west, then $|\mathbf{a} - \mathbf{b}| =$

(a)25 (b) 5 (c) $7\sqrt{3}$ (d) $5\sqrt{2}$

Q.10. If **a** and **b** are two vectors such that **a** . **b** = 0 and $\mathbf{a} \times \mathbf{b} = \mathbf{0}$, then

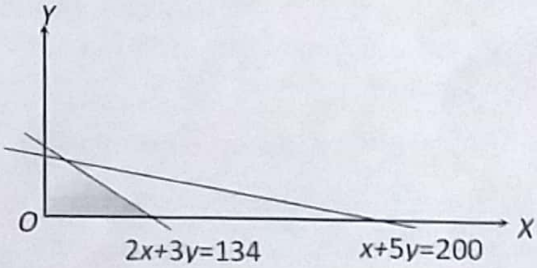
(a) **a** is parallel to **b** (b) **a** is perpendicular to **b**

(c) Either **a** or **b** is a null vector (d) None of these

Q.11. The maximum value of objective function $c = 2x + 2y$ in the given feasible region, is

(a) 134 (b)40

(c) 138 (d) 80



Q.12. $\int \frac{\tan x}{\sec x + \tan x} dx =$

(a) $\sec x + \tan x - x + c$ (b) $\sec x - \tan x + x + c$

(c) $\sec x + \tan x + x + c$ (d) $-\sec x - \tan x + x + c$

Q.13. If $\int_0^k \frac{dx}{2 + 8x^2} = \frac{\pi}{16}$, then $k =$

(a) 1 (b) $\frac{1}{2}$ (c) $\frac{1}{4}$ (d) None of these

Q.14. Integrating factor of equation $(x^2 + 1)\frac{dy}{dx} + 2xy = x^2 - 1$ is

(a) x^2+1 (b) $\frac{2x}{x^2+1}$ (c) $\frac{x^2-1}{x^2+1}$ (d) None of these

Q.15. If $\sin^{-1}x+\sin^{-1}y=\frac{2\pi}{3}$, then $\cos^{-1}x+\cos^{-1}y=$

(a) $\frac{2\pi}{3}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{6}$ (d) π

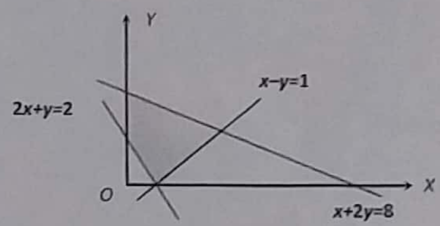
Q.16. For the following shaded area, the linear constraints except $x\geq 0$ and $y\geq 0$, are

(a) $2x+y\leq 2, x-y\leq 1, x+2y\leq 8$

(b) $2x+y\geq 2, x-y\leq 1, x+2y\leq 8$

(c) $2x+y\geq 2, x-y\geq 1, x+2y\leq 8$

(d) $2x+y\geq 2, x-y\geq 1, x+2y\geq 8$



Q.17. Function $f(x)=\begin{cases} x-1, x<2 \\ 2x-3, x\geq 2 \end{cases}$ is a continuous function

(a) For all real values of *x* (b)For $x=2$ only

(c) For all real values of *x* such that $x\neq 2$ (d)For all integral values of *x* only

Q.18. The area of the region bounded by the curves $y=|x-2|$, $x=1$, $x=3$ and the *x*-axis is

(a) 4 (b) 2 (c) 3 (d) 1

ASSERTION-REASON BASED QUESTIONS

Question numbers 19 and 20 are Assertion-Reason based questions carrying 1 mark each. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the options (A), (B), (C) and (D) as given below.

(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.

Q.19. **Assertion(A)** : Function $f(x) = |x|$, is not differentiable at x=0

Reason(R) : If a function is continuous at a point then it is differentiable at that point .

Q.20. **Assertion(A)** : Let a relation R defined from set A = { 1,2,5,6 } to A is
R = {(1,1), (1,6),(6,1)} , then R is symmetric

Reason(R) : A relation R in set A is called symmetric if (a ,b) ∈ R→ (b ,a) ∈ R for every a ,b ∈ A

SECTION – B [2× 5 = 10]

Q.21. Find the domain of functions : $f(x) = \cos^{-1}\frac{3x-1}{2}$

Q.22. The volume of a cube is increasing at the rate of 8 cm^3/s . How fast is the surface area increasing when the length of its edge is 12 cm ?

Q.23. Find the derivative of $\log x$ with respect to $\tan^{-1}x$. Where x ∈ $(0,\infty)$

OR

Differentiate the function with respect to x : $f(x) = x^{\cos x}$

Q.24. Find the value of b such that scalar product of the vectors $(\mathbf{i}+\mathbf{j}+\mathbf{k})$ with the unit vector parallel to the sum of the vectors $(2\mathbf{i}+4\mathbf{j}-5\mathbf{k})$ and $(b\mathbf{i}+2\mathbf{j}+3\mathbf{k})$ is 1 .

OR

Find a unit vector perpendicular to each of the vector $\bar{a} + \vec{b}$ and $\bar{a} - \vec{b}$, where $\bar{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$

Q.25. Using vectors , find the area of the ΔABC with vertices A (1,1,1) , B (1,2 , 3) and C (2 ,3, 1)

SECTION –C [$3\times 6 = 18$]

Q.26. Solve $\dfrac{dy}{dx} = \dfrac{x^2 + y^2}{2xy}$, x=2 ,y=1 .

OR

Find the general solution of the differential equation $\dfrac{dy}{dx} + y\sec^2 x = \tan x \sec^2 x$

Q.27. Find the intervals in which function $f(x) = \sin 3x$, $x \in \left[0, \frac{\pi}{2}\right]$ is :

(a) strictly increasing (b) strictly decreasing

Q.28. If with reference to a right handed system of mutually perpendicular unit vectors $\hat{i}$, $\hat{j}$ and $\hat{k}$. We have $\bar{\alpha} = 3\hat{i} - \hat{j}$ and $\bar{\beta} = 2\hat{i} + \hat{j} - 3\hat{k}$. Express $\bar{\beta}$ in the form of $\bar{\beta} = \overline{\beta_1} + \overline{\beta_2}$, where $\overline{\beta_1}$ is parallel to $\bar{\alpha}$ and $\overline{\beta_2}$ is perpendicular to $\bar{\alpha}$.

OR

If **a** ,**b** ,**c** are unit vectors such that **a** is perpendicular to both **b** and **c** and angle between vectors **b** and **c** is $\frac{\pi}{6}$ then show that **a** = $\pm 2(\boldsymbol{b} \times \boldsymbol{c})$

Q.29. Evaluate : $\int \frac{e^x(x-3)}{(x-1)^3}dx$ OR $\int_{-2}^{2} \frac{x^2}{1+5^x}$ dx

Q.30. Consider the following Linear Programming Problem:

Minimise Z= x + 2y

Subject to 2x+y≥3 , x+2y ≥ 6 , x≥0 , y≥0 .

Show graphically that the minimum of Z occurs at more than two points

Q.31 From a lot of 15 bulbs which include 5 defectives , a sample of 2 bulbs is drawn at random (without replacement) Find the probability distribution of the number of defective bulbs . Also find the mean of number of defective.

OR

Probability of solving specific problem independently by A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively . If both try to solve the problem , then find the probability that

(I) the problem is solved

(ii) exactly one of them solves the problem

SECTION –D [$5\times 4 = 20$]

Q.32. Draw the rough sketch of the curve $y = x|x|$.

Using integration, find the area of the region bounded by the curve $y = x|x|$ from the

	ordinates $x = -1$ to $x = 2$ and the $X - axis.$
Q.33.	Use the product $\begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix} \begin{bmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & -2 \end{bmatrix}$ to solve the system of equation x + 3z = 9 , -x +2y – 2z =4 and 2x – 3y + 4z = 3
Q.34.	If y = $\log[x + \sqrt{x^2+1}]$, then prove that : $(x^2+1)\frac{d^2y}{dx^2}$ +x$\frac{dy}{dx}$ = 0 **OR** If x = a($\theta + \sin\theta$) and y = a$(1 - \cos\theta)$, find $\frac{d^2y}{dx^2}$
Q.35	Find the shortest distance between the lines $\frac{x-3}{3} = \frac{y-8}{-1} = \frac{z-3}{1}$ and $\frac{x+3}{-3} = \frac{y+7}{2} = \frac{z-6}{4}$ **OR** Show that the lines $\frac{x+1}{3} = \frac{y+3}{5} = \frac{z+5}{7}$ and $\frac{x-2}{1} = \frac{y-4}{3} = \frac{z-6}{5}$ intersect . Also find their point of intersection .

SECTION-E [$4\times 3 = 12$]

This section comprises of **3 case-study/passage-based questions of 4 marks** each with subparts. The first two case study questions have three subparts (i), (ii), (iii) of marks 1, 1, 2 respectively. The third case study question has two subparts of 2 marks each

Case Study-1

Q.36	A boy wants to make a square and a circle for a project assigned to him from school using a copper wire . He has a 40 meter long copper wire. He cuts the wire into two pieces. Length of first piece of wire is 'x' m is bent to form a square and other is bent to form a circle. On the basis of information given above give the answers of following questions (i) Find the combined area of square and circle in terms of 'x' (ii) For what value of 'x' combined area of square and circle is minimum ? (iii)Find the radius of circle for minimum combined area of square and circle Or Find the minimum combined area of square and circle.

Case Study-2

Q.37	A relation R on set A is said to be an equivalence relation iff it is • Reflexive i.e.(a,a) ∈ R , ∀ a ∈ A • Symmetric i.e. (a,b) ∈ R⇒ (b,a) ∈ R , ∀ a , b ∈ A • Transitive i.e. (a,b) ∈ R , (b,c) ∈ R ⇒(a,c) ∈ R , ∀ a , b,c ∈ A Based on above information answer the following questions: (i) Give an example of a relation which is neither reflexive nor symmetric but transitive. (ii) Give the largest equivalence relations on set A = { 1,2,3} (iii) For real numbers *x* and *y*, we write *xRy* ⇔ x-y is an even number . Show that relation *R* is an Reflexive relation and Symmetric. or Relation R={ (x,y): y=x^2,x,y are real } Show that R is not Transitive.

	Case Study-3
Q.38.	Three persons A , B and C apply for a job of manager in a private company . Chance of their selection are in the ratio 1:2:4 The probability that A , B and C can introduce changes to improve profits of company are 0.8 , 0.5 and 0.3 respectively . Based on the above information answer the following questions : (I) Find the probability of introducing change . (II) If the change has been introduced then find the probability that it is introduced by A