SET-1

Kendriya Vidyalaya Sangathan Varanasi Region

Pre-Board Examination-1, 2024-25

Class -XII | Subject- Mathematics

Maximum Max- 80 | Maximum Time-3 Hours

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 **[1x20=20]**

(This section comprises of multiple-choice questions (MCQs) of 1 mark each)

Select the correct option (Question 1 - Question 18):

1. $\tan^{-1}\left\{sin\left(-{}^{\pi}/_{2}\right)\right\}$ is equal to

(a) -1 (b) 1 (c) ${}^{\pi}/_{2}$ (d) $-{}^{\pi}/_{4}$

2. If A is a square matrix such that $A^2=A$ then

$(I+A)^2-3A$ is

(a) I (b) 2A (c) 3I (d) A

3. If A and B are matrices of order $3\times m$ and $3\times n$ respectively such that $m=n$, then order of 2A+7B is

(a) 3×3 (b) $m\times 3$ (c) $n\times 3$ (d) $3\times m$

4. If $A=\begin{bmatrix}0 & a\\0 & 0\end{bmatrix}$ $then\ A^{16}\ is\ equal\ to$

(a) $\begin{bmatrix}0 & 0 & 0\\0 & 0 & 0\end{bmatrix}$ (b) $\begin{bmatrix}0 & a^{16}\\0 & 0\end{bmatrix}$ (c) A (d) $\begin{bmatrix}0 & 0\\0 & 0\end{bmatrix}$

5. If A is a square matrix of order 3x3 such that A. (AdjA) = 10 I then $|(Adj.A)|$ is

(a) 1 (b) 10 (c) 100 (d) 1000

6. If A and B are invertible matrices of the same order. Given $|(AB)^{-1}| = 8$ and $|A| = {}^{3}/_{4}$ $then$ $|B|$ is

(a) 6 (b) ${}^{1}/_{6}$ (c) ${}^{4}/_{3}$ (d) $-{}^{1}/_{6}$

7. Derivative of x^x with respect to x is

$(a)\ log(1+x)$ $(b)\ x.x^{x-1}$ $(c)\ x^x(1+logx)$ $(d)\ x^x log(1+x)$

8. The total revenue in the ₹ received from the sale of x units of an article is given by $R(x)=3x^2+36x+5$. The marginal revenue when x = 15 is (in ₹)

(a) 126 (b) 116 (c) 96 (d) 90

9. The function f(x)= $cos\left(2x + {}^{\pi}/_{4}\right), x \in \left[\frac{3\pi}{8}, \frac{5\pi}{8}\right]$

(a) Increasing (b) decreasing (c) neither increasing nor decreasing (d) none of these.

10. $\int_{-1}^{1} |1-x|$ dx is equal to

(a) 1 (b) 2 (c) 3 (d) −3

11. If p and q are the degree and order of the differential equation

$\left(\frac{d^2y}{dx^2}\right)^2 + 3\frac{dy}{dx} + \frac{d^3y}{dx^3} = 4$ then the value of 2p−3q is

(a) 7 (b) −7 (c) 3 (d) −3

12. The value of p for which $\vec{a} = 3\hat{\imath} + 2\hat{\jmath} + 9\hat{k}$ and $\vec{b} = \hat{\imath} + p\hat{\jmath} + 3\hat{k}$ are parallel vectors is

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

13. A line makes angle α, β, γ, with x-axis, y-axis and z-axis respectively then

$cos2\alpha + cos2\beta + cos2\gamma$ is equal to

(a) 2 (b) 1 (c) – 2 (d) −1

14. Direction ratio of the line $\frac{4-x}{2} = \frac{y}{6} = \frac{1-z}{3}$ are

(a) 2, 6, 3 (b) – 2, 6, 3 (c) 2, − 6, 3 (d) none of these.

15. Vector equation of the line $\frac{x-5}{3} = \frac{y+4}{7} = \frac{6-z}{2}$ is

$(a)\ \vec{r} = -3\hat{\imath} + 7\hat{\jmath} - 2\hat{k} + \mu\left(5\hat{\imath} - 4\hat{\jmath} + 6\hat{k}\right)$

$(b)\ \vec{r} = 5\hat{\imath} - 4\hat{\jmath} + 6\hat{k} + \mu\left(3\hat{\imath} + 7\hat{\jmath} - 2\hat{k}\right)$

$(c)\ \vec{r} = -5\hat{\imath} + 4\hat{\jmath} - 6\hat{k} + \mu\left(-3\hat{\imath} - 7\hat{\jmath} - 2\hat{k}\right)$

$(d)\ \vec{r} = 3\hat{\imath} + 7\hat{\jmath} + 2\hat{k} + \mu\left(-5\hat{\imath} + 4\hat{\jmath} - 6\hat{k}\right)$

16. The objective function for a given linear programming problem is Z=ax +by−5. If Z attains same value at (1,2) and (3,1) then.

(a) 2a−b=0 (b) a + 2b = 0 (c) a + b = 0 (d) a = b

17. For a given LPP, corner points of a closed feasible region are A (3,5), B (4,2), C (3,0) and O (0,0), then objective function Z= px + qy attains maximum at

(a) A (b) B (c) Cor O (d) It depends upon values of p and q and points A, B, C.

18. If A and B are independent events such that P(B/A) = 2/5 then P(B') is

(a) 1/5 (b) 2/5 (c) 3/5 (d) 4/5

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.

19. Assertion (A): In set A = {1, 2, 3} a relation R defined as R = {(1, 1), (2, 2)}is reflexive.

Reason (R): A relation R is reflexive in set A if (a, a)∈ R for all a∈A.

20. Assertion (A): f(x)=[x]is not differentiable at x = 2.

Reason (R): f(x) = [x] is not Continuous at x=2.

SECTION B **[2x5=10]**

(This section comprises of 5 very short answer (VSA) type questions of 2 marks each.)

21. Find the value of $\tan^{-1}\left[2sin\left(2cos^{-1}\frac{\sqrt{3}}{2}\right)\right]$

22. Find $\frac{dy}{dx}$ $at\ t = \frac{2\pi}{3}$ when

$x = 10\ (t - sin\ t)$ and $y = 12(1 - cos\ t)$

OR

Differentiate $\sin^{-1}x^2$, with respect to x.

23. Find $\int \frac{1+tanx}{1-tanx}$ dx

24. Find Integrating factor for the differential equation.

$x\frac{dy}{dx} + 2y = x^2$

25. Find the direction cosine of the line passing through the following points. (-2,4,5), (1,2,3)

OR

Find the cartesian equation of the line which passes through the point (-2, 4, -5) and is parallel to the line $\frac{x+3}{3} = \frac{4-y}{5} = \frac{z+8}{6}$.

SECTION C **[3x6=18]**

(This section comprises of 6 short answer (SA) type questions of 3 marks each.)

26. Find the intervals in which the function f given by $f(x) = x^3 - 12x^2 + 36x + 17$ is increasing or decreasing.

27. Find $\int \frac{Sinx}{(1-Cosx)(2-Cosx)}$ dx

OR

$\int_0^{\pi} \frac{x}{a^2Cos^2x+b^2Sin^2x}$ dx

28. Solve the differential equation xdy−ydx $=\sqrt{x^2+y^2}$ dx

29. Find a vector of magnitude 6, perpendicular to each of the vector $(\vec{a}+\vec{b})$ *and* $(\vec{a}-\vec{b})$, where

$\vec{a} = \hat{\imath}+\hat{\jmath}+\hat{k}$ *and* $\vec{b} = \hat{\imath}+2\hat{\jmath}+3\hat{k}$

OR

Show that the points A, B, C with position vectors $2\hat{\imath}-\hat{\jmath}+\hat{k}, \hat{\imath}-3\hat{\jmath}-5\hat{k}$ and $3\hat{\imath}-4\hat{\jmath}-4\hat{k}$ respectively, are vertices of a right-angled triangle. Also find the area of the triangle.

30. Solve the following problem graphically: Minimise and Maximise Z = 3x+9y subject to the constraints.

$x+3y \leq 60$

$x+y \geq 10$

$x \leq y$

$x, y \geq 0$

31. Two cards are drawn simultaneously from a well shuffled pack of 52 cards. Find the mean of the number of kings.

OR

A Random variable X has the following probability distribution.

X	0	1	2	3	4	5	6	7
P(X)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

Find (i) k (ii) P($X<3$) (iii) P $(0<X<3)$

SECTION-D **[5x4=20]**

(This section comprises of 4 long answer (LA) type questions of 5 marks each)

32. Differentiate $(sinx)^x + sin^{-1}\sqrt{x}$ $w.r.t.x$

OR

If y= $sin(logx)$. Prove that $x^2y_2+xy_1+y=0$

33. Show that lines $\vec{r} = (\hat{\imath}+\hat{\jmath}-\hat{k}) + \lambda(3\hat{\imath}-\hat{\jmath})$ *and* $\vec{r} = (4\hat{\imath}-\hat{k}) + \mu(2\hat{\imath}+3\hat{k})$ intersect. Also find their point of intersection.

OR

Find the length and the foot of the perpendicular drawn from the point (2, -1, 5) on the line

$$\frac{x-11}{10} = \frac{y+2}{-4} = \frac{z+8}{-11}$$

34. Sketch and find the area of the region

{(x, y): $x^2+y^2 \leq 16$, $y^2=6x$} Using integration.

35. Two schools A and B want to award their selected students on the values of Sincerity, Truthfulness and Helpfulness. The school A wants to award ₹x each, ₹y each and ₹z each for the three respective values to 3, 2 and 1 students respectively with a total award money of ₹1,600. School B wants to spend ₹2,300 to award its 4, 1 and 3 students on the respective values (by giving the same award money to the three values as before). If the total amount of award for one prize on each value is ₹900, using matrices find the award money for each value.

SECTION- E **[4x3=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

36. Students of Grade 9, planned to plant saplings along straight lines, parallel to each other to one side of the playground ensuring that they had enough play area Let us assume that they planted one of the rows of the saplings along the line $y = x-4$. Let L be the set of all lines which are parallel on the ground and R be a relation on L.

Answer the following using the above information.

(i) Let relation R be defined by R= {(L_1, L_2): $L_1 || L_2$ where $L_1, L_2 \in L$} then find the set of lines related to

The liner $y = x - 4$. **[1Mark]**

(ii) Let R= {(L_1, L_2): $L_1 \perp L_2$ where $L_1, L_2 \in L$} then, show that R is symmetric but neither reflexive nor transitive. **[1Mark]**

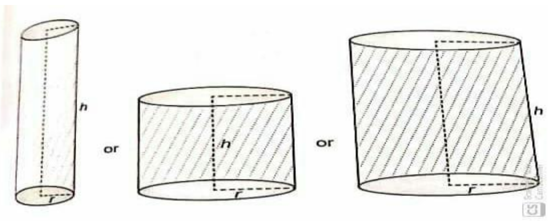
(iii) Prove that the function $f: R \rightarrow R \ defined\ by\ f(x) = x - 4$ is bijective. **[2Mark]**

OR

Let $f: R \rightarrow R$ be defined by f(x) = x - 4 Then find the range of f(x). **[2Mark]**

Case Study-2

37. Read the following passage and answer the questions given below



A company is launching a new product and decided to pack the product in the form of a closed right circular cylinder of volume 432π ml and having minimum surface area as shown. They tried different options and tried to get the solution by answering the questions given below:

(i) If r is radius of base of cylinder and h is the height of cylinder then establish the relation between r and h. **[1Mark]**

(ii) Find total surface area in terms of r only. **[1Mark]**

(iii) Find the radius r for minimum surface area. **[2Mark]**

OR

(iii) Find the minimum surface area. **[2Mark]**

Case Study-3

38. Read the following passage and answer the questions given below

In the office three employees Mehul, Janya and Charvi process incoming matter related to a particular project. Mehul processes 40% of the matter and Janya and Charvi process rest of the matter equally. It is found that 6% of matter processed by Mehul has an error whereas for Janya and Charvi error rate is 4% and 3% respectively.

(i) What is the probability of an error in processing the matter? **[2Mark]**

(ii) The processed matter is checked and the selected matter has an error, what is the probability that it was processed by Mehul? **[2Mark]**