KENDRIYA VIDYALAYA SANGATHAN, RAIPUR REGION

FIRST PRE-BOARD EXAM (2025-26)

Subject: Mathematics

Class: XII **Time: 3 hours**

MM: 80

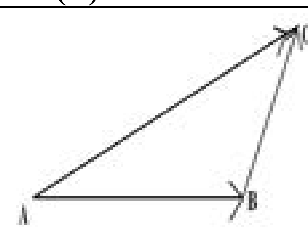
General Instructions

Read the following instructions very carefully and strictly follow them:

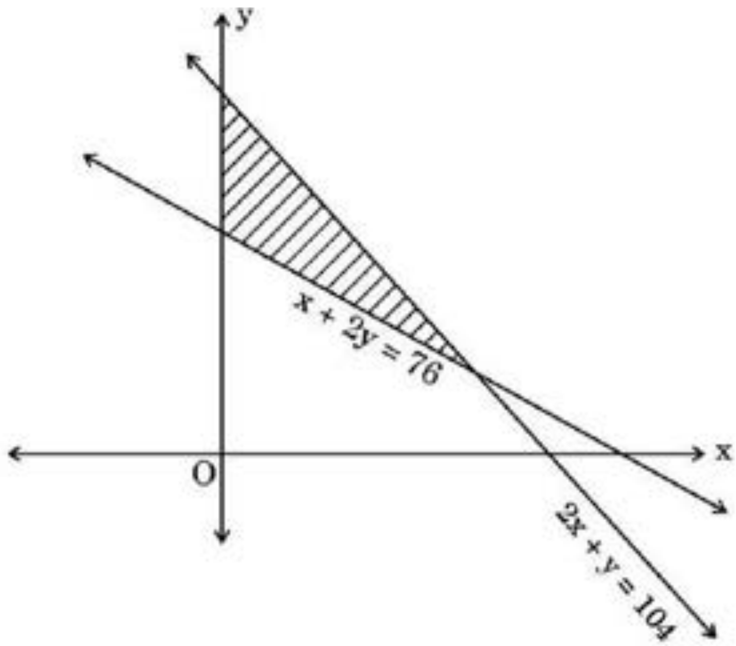
(i). This Question Paper contains 38 questions. All questions are compulsory.
(ii). Question Paper is divided into five Sections – Section A, B, C, D and E.
(iii). In Section A – Questions no. 1 to 18 are Multiple Choice Questions (MCQs) and Questions no. 19 & 20 are Assertion-Reason based questions 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 3 questions in Section E.
(ix). Use of calculators is not allowed.

SECTION – A $(20 \times 1 = 20)$

This section comprises of 20 Multiple Choice Questions (MCQs) of 1 mark each.

Q.NO.	QUESTIONS	MARKS
1.	If $A = \begin{bmatrix} 4 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 6 \end{bmatrix}$, then A^{-1} is (A) $\begin{bmatrix} \frac{1}{4} & 0 & 0 \\ 0 & \frac{1}{5} & 0 \\ 0 & 0 & \frac{1}{6} \end{bmatrix}$ (B) $120\begin{bmatrix} \frac{1}{4} & 0 & 0 \\ 0 & \frac{1}{5} & 0 \\ 0 & 0 & \frac{1}{6} \end{bmatrix}$ (C) $\frac{1}{120}\begin{bmatrix} 4 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 6 \end{bmatrix}$ (D) $\frac{1}{120}\begin{bmatrix} \frac{1}{4} & 0 & 0 \\ 0 & \frac{1}{5} & 0 \\ 0 & 0 & \frac{1}{6} \end{bmatrix}$	1
2.	The value of $\int_{-1}^{1} \lvert x \rvert \, dx$ is: (A) -2 (B) 1 (C) -1 (D) 2	1
3.	In the given triangle ABC, which of the following is not true: (A) $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{AC} = \vec{0}$ (B) $\overrightarrow{AB} + \overrightarrow{BC} - \overrightarrow{AC} = \vec{0}$ (C) $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CA} = \vec{0}$ (D) $\overrightarrow{AB} - \overrightarrow{CB} + \overrightarrow{CA} = \vec{0}$ 	1

4.	If for the matrix $A = \begin{bmatrix} tanx & 1 \\ -1 & tanx \end{bmatrix}$, $A + A' = 2\sqrt{3}I$, then the value of $x \in \left[0, \frac{\pi}{2}\right]$ is: (A) 0 (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{6}$	1
5.	For what value of k, the function given below is continuous at $x = 0$? $$f(x) = \begin{cases} \frac{\sqrt{4+x}-2}{x}, & x \neq 0 \\ k, & x = 0 \end{cases}$$ (A) 0 (B) $\frac{1}{4}$ (C) 1 (D) 4	1
6.	If $P(A) = \frac{1}{2}$, P(B) = 0, then P(A|B) is (A) 0 (B) $\frac{1}{2}$ (C) not defined (D) 1	1
7.	Let R be the relation in the set {1, 2, 3, 4} given by R = {(1, 2), (2, 2), (1, 1), (4, 4), (1, 3), (3, 3), (3, 2)}. Choose the correct answer. (A) R is reflexive and symmetric but not transitive. (B) R is reflexive and transitive but not symmetric. (C) R is symmetric and transitive but not reflexive. (D) R is an equivalence relation.	1
8.	The total revenue in Rupees received from the sale of x units of a product is given by $R(x) = 3x^2 + 36x + 5$. The marginal revenue, when $x = 15$ is (A) 116 (B) 96 (C) 90 (D) 126	1
9.	Area lying in the first quadrant and bounded by the circle $x^2 + y^2 = 4$ and the lines $x = 0$ and $x = 2$ is (A) π (B) $\frac{\pi}{2}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{4}$	1
10.	The degree and order of differential equation $y = px + \sqrt{1+p^2}$, where $p = \frac{dy}{dx}$ respectively are: (A) 1, 2 (B) $\frac{1}{2}$, 2 (C) 2, $\frac{1}{2}$ (D) 2, 1	1
11.	If a_{ij} and A_{ij} represent the $(ij)^{th}$ element and its cofactor of $\begin{bmatrix} 1 & 2 & 5 \\ 6 & -3 & -2 \\ 0 & 5 & 7 \end{bmatrix}$ respectively, then the value of $a_{11}A_{21} + a_{12}A_{22} + a_{13}A_{23}$ is : (A) 0 (B) – 28 (C) 114 (D) – 114	1

12.	**Of the following, which group of constraints represents the feasible region given below?** **(A)** $x + 2y \leq 76, 2x + y \geq 104,\ x, y \geq 0$ **(B)** $x + 2y \leq 76, 2x + y \leq 104,\ x, y \geq 0$ **(C)** $x + 2y \geq 76, 2x + y \leq 104,\ x, y \geq 0$ **(D)** $x + 2y \geq 76, 2x + y \geq 104,\ x, y \geq 0$ 	**1**
13.	**The value of** $(\hat{\imath} \times \hat{\jmath}).\hat{\jmath} + (\hat{\jmath} \times \hat{\imath}).\hat{k}$ **is:** **(A) 2** **(B) 0** **(C) 1** **(D) -1**	**1**
14.	$\int \frac{1}{x(\log x)^2} dx$ **is equal to** **(A)** $-\frac{1}{\log x} + c$ **(B)** $2\log(\log x) + c$ **(C)** $\frac{(\log x)^3}{3} + c$ **(D)** $\frac{3}{(\log x)^3} + c$	**1**
15.	$x \log x \frac{dy}{dx} + y = 2 \log x$ **is an example of a :** **(A) variable separable differential equation.** **(B) homogeneous differential equation.** **(C) first order linear differential equation.** **(D) differential equation whose degree is not defined**	**1**
16.	**If** $A = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$ **and** $(3I + 4A)(3I - 4A) = x^2 I$**, then the value(s) of x is/are:** **(A)** $\pm\sqrt{7}$ **(B)** ± 5 **(C) 0** **(D) 25**	**1**
17.	**The integrating factor of the differential equation** $x\frac{dy}{dx} - y = x^4 - 3x$ **is :** **(A) x** **(B) -x** **(C)** x^{-1} **(D)** $\log(x^{-1})$	**1**
18.	**The corner points of the feasible region in the graphical representation of a linear programming problem are (0, 0), (0, 60), (10, 50) and (20, 0). If z = 250x + 75y be the objective function, then :** **(A) z is maximum at (10, 50), minimum at (20, 0)** **(B) z is maximum at (0, 60), minimum at (0, 0)** **(C) z is maximum at (10, 50), minimum at (0, 0)** **(D) z is maximum at (20, 0), minimum at (0, 60)**	**1**

	Questions No. 19 & 20, are Assertion (A) and Reason (R) 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 codes (A), (B), (C) and (D) as given below: **(A) Both Assertion (A) and Reason (R) are true and the Reason (R) is the correct explanation of Assertion (A).** **(B) Both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of the Assertion (A).** **(C) Assertion (A) is true, but Reason (R) is false.** **(D) Assertion (A) is false, but Reason (R) is true.**	
19.	**Assertion (A): The range of the function $f(x) = 2\sin^{-1}x + \frac{3\pi}{2}$, where $x \in [-1, 1]$, is $\left[\frac{\pi}{2}, \frac{5\pi}{2}\right]$.** **Reason (R): The range of the principal value branch of $\sin^{-1}x$ is $[0, \pi]$.**	1
20.	**Assertion (A): For any symmetric matrix A, $B'AB$ is a skew-symmetric matrix.** **Reason (R): A square matrix P is skew-symmetric if $P' = -P$.**	1

SECTION – B **$(5 \times 2 = 10)$**

This section comprises of 5 Very Short Answer (VSA) type questions of 2 marks each.

21.	**Differentiate $sin^2 x$ with respect to $e^{\cos x}$.** **OR** **Differentiate $\tan^{-1}\left(\frac{\sin x}{1+\cos x}\right)$ with respect to x.**	**2**
22.	**Using Vector Algebra, find the area of the triangle with vertices A(1, 1, 2), B(2, 3, 5) and C(1, 5, 5)**	**2**
23.	**Find the value of $\cos^{-1}\left(-\frac{1}{\sqrt{2}}\right) + \tan^{-1}\left(\frac{1}{\sqrt{3}}\right) + \tan^{-1}\left[\sin\left(-\frac{\pi}{2}\right)\right]$.**	**2**
24.	**Show that $f(x) = e^x - e^{-x} + x - \tan^{-1}x$ is strictly increasing in its domain.**	**2**
25.	**If the projection of the vector $\hat{\imath} + \hat{\jmath} + \hat{k}$ on the vector $p\hat{\imath} + \hat{\jmath} - 2\hat{k}$ is $\frac{1}{3}$, then find the value(s) of p.** **OR** **An instructor at the astronomical centre shows three among the brightest stars in a particular constellation. Assume that the telescope is located at O (0, 0, 0) and the three stars have their locations at the points D, A and V having position vectors $2\hat{\imath} + 3\hat{\jmath} + 4\hat{k}$, $7\hat{\imath} + 5\hat{\jmath} + 8\hat{k}$ and $-3\hat{\imath} + 7\hat{\jmath} + 11\hat{k}$ respectively. Find the value of the $\angle VDA$.**	**2**

SECTION – C **$(6 \times 3 = 18)$**

This section comprises of 6 Short Answer (VSA) type questions of 3 marks each.

26.	**Find the absolute maximum and minimum values of a function *f* given by $f(x) = 2x^3 - 15x^2 + 36x + 1$ on the interval $[1, 5]$.**	**3**
27.	**If $x = \left(t + \frac{1}{t}\right)^a$, $y = a^{t+\frac{1}{t}}$, find $\frac{dy}{dx}$.** **OR** **Find $\frac{dy}{dx}$ if $y = (\cos x)^x + \cos^{-1}\sqrt{x}$ is given.**	**3**

28.	**Sketch the graph of $y = \|x+4\|$ and find the area enclosed by the curve, x-axis, between $x = -8$ and $x = 0$, using integration.**	**3**
29.	**Find the shortest distance between the lines $\vec{r} = \hat{\imath} + 2\hat{\jmath} + \hat{k} + \lambda(\hat{\imath} - \hat{\jmath} + \hat{k})$ and $\vec{r} = 2\hat{\imath} - \hat{\jmath} - \hat{k} + \mu(2\hat{\imath} + \hat{\jmath} + 2\hat{k})$.** **OR** **Find the vector equation of a line perpendicular to the lines $\frac{x-1}{-3} = \frac{y-2}{2} = \frac{z-3}{2}$ and $\frac{x-1}{3} = \frac{y-1}{1} = \frac{z-6}{-7}$ and passing through the point $(3, -4, 7)$.**	**3**
30.	**Solve the following linear programming problem graphically:** **Maximize $Z = 3x + 2y$ subject to the constraints** $x + 2y \leq 10$, $3x + y \leq 15$, $x, y \geq 0$.	**3**
31.	**In a hostel, 60% of the students read Hindi newspaper, 40% read English newspaper and 20% read both Hindi and English newspapers. A student is selected at random.** **(a) Find the probability that she reads neither Hindi nor English newspapers.** **(b) If she reads Hindi newspaper, find the probability that she reads English newspaper.** **(c) If she reads English newspaper, find the probability that she reads Hindi newspaper.** **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 independently, find the probability that** **(i) the problem is solved (ii) exactly one of them solves the problem.**	**3**

SECTION – D **$(4 \times 5 = 20)$**

This section comprises of 4 Long Answer (LA) type questions of 5 marks each.

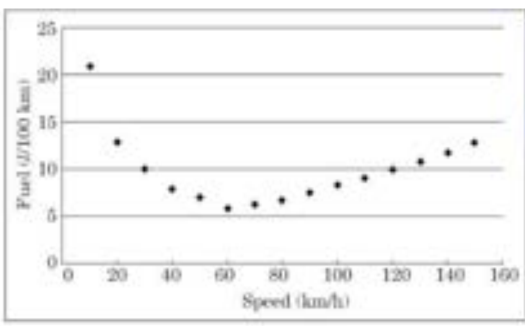
32.	**Find:** $\int [\sqrt{\cot x} + \sqrt{\tan x}]\, dx$ **OR** **Evaluate:** $\int_0^{\frac{\pi}{4}} \frac{\sin x + \cos x}{9 + 16 \sin 2x} dx$	**5**
33.	**Show that the differential equation $2ye^{\frac{x}{y}}dx + \left(y - 2xe^{\frac{x}{y}}\right) dy = 0$ is homogeneous and find its particular solution, given that, x = 0 when y = 1.**	**5**

34.	**Find the image P' of the point $P(1, 3, 2)$ in the line $\frac{x}{1} = \frac{y-2}{2} = \frac{z-3}{3}$. Also, find the equation of the line joining P and P'.** **OR** **Two vertices of the parallelogram ABCD are given as A(–1, 2, 1) and B(1, –2, 5). If the equation of the line passing through C and D is $\frac{x-4}{1} = \frac{y+7}{-2} = \frac{z-8}{2}$, then find the distance between sides AB and CD. Hence, find the area of parallelogram ABCD.**	**5**
35.	**Use the product $\begin{bmatrix} 1 & 2 & -3 \\ 3 & 2 & -2 \\ 2 & -1 & 1 \end{bmatrix}\begin{bmatrix} 0 & 1 & 2 \\ -7 & 7 & -7 \\ -7 & 5 & -4 \end{bmatrix}$ to solve the following system of equations:** $x + 2y - 3z = 6, 3x + 2y - 2z = 3, 2x - y + z = 2.$	**5**

SECTION – E **(3 × 4 = 12)**

This section comprises of 3 case study based questions of 4 marks each.

36.	**Airplanes are by far the safest mode of transportation when the number of transported passengers is measured against personal injuries and fatality totals. Previous records state that the probability of an airplane crash is 0·00001%. Further, there are 95% chances that there will be survivors after a plane crash. Assume that in case of no crash, all travelers survive.** **Let E_1 be the event that there is a plane crash and E_2 be the event that there is no crash. Let A be the event that passengers survive after the journey.**  **On the basis of the above information, answer the following questions :** **(i) Find the probability that the airplane will not crash.** **(ii) Find P(A | E_1) + P(A | E_2).** **(iii) (a) Find P(A).** **OR** **(iii) (b) Find P(E_2 | A).**	**4 (1+1 + 2)**

37.	**A classroom teacher is keen to assess the learning of her students the concept of "relations" taught to them. She writes the following five relations each defined on the set A = {1,2,3} as follows:** $R_1 = \{(2,3), (3,2)\}$ $R_2 = \{(1,2), (1,3), (3,2)\}$ $R_3 = \{(1,2), (2,1), (1,1)\}$ $R_4 = \{(1,1), (1,2), (3,3), (2,2)\}$ $R_5 = \{(1,1), (1,2), (3,3), (2,2), (2,1), (2,3), (3,2)\}$ **The students are asked to answer the following questions about the above relations:** **(i) Identify the relation which is reflexive, transitive but not symmetric.** **(ii) Identify the relation which is reflexive and symmetric but not transitive.** **(iii) (a) Identify the relations which are symmetric but neither reflexive nor transitive.** **OR** **(iii) (b)What pairs should be added to the relation R_2 to make it an equivalence relation?**	**4** **(1+1 + 2)**
38.	**Over speeding increases fuel consumption and decreases fuel economy as a result of tyre rolling friction and air resistance. While vehicles reach optimal fuel economy at different speeds, fuel mileage usually decreases rapidly at speeds above 80 km/h. The relation between fuel consumption F (l/100 km) and speed V (km/h) under some constraints is given as** $F = \frac{V^2}{500} - \frac{V}{4} + 14.$  **On the basis of the above information, answer the following questions :** **(i) Find F, when V = 40 km/h.** **(ii) Find** $\frac{dV}{dF}$ **.** **(iii) (a) Find the speed V for which fuel consumption F is minimum.** **OR** **(iii) (b) Find the quantity of fuel required to travel 600 km at the speed V at which** $\frac{dF}{dV} = -0.01$	**4** **(1+1 + 2)**