



CHENNAI SAHODAYA SCHOOLS COMPLEX

(General Instructions)

- ❖ Please check that this question paper contains 5 printed pages.
- ❖ Please write down the serial number of the question before attempting it.
- ❖ Reading time of 15 minutes is given to read the question paper alone. No writing during this time.
- ❖ This Question paper contains 38 questions. All questions are compulsory.
- ❖ This Question paper is divided into five Sections - A, B, C, D and E.
- ❖ 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.
- ❖ In Section B, Questions no. 21 to 25 are Very Short Answer (VSA) - type questions, carrying 2 marks each.
- ❖ In Section C, Questions no. 26 to 31 are Short Answer (SA) - type questions, carrying 3 marks each.
- ❖ In Section D, Questions no. 32 to 35 are Long Answer (LA) - type questions, carrying 5 marks each.
- ❖ In Section E, Questions no. 36 to 38 are case study-based questions carrying 4 marks each.
- ❖ There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D and one sub-part each in 2 questions of Section E.
- ❖ Use of calculators is not allowed.

COMMON EXAMINATION Class-12 (Mathematics 041/3)

Roll No.:

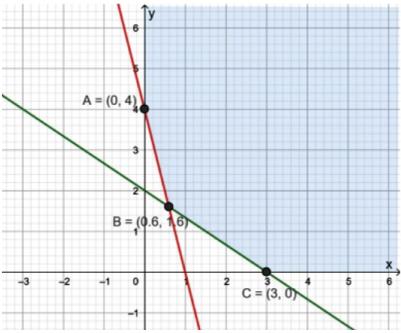
Maximum Marks: 80

Date: 17/12/2025

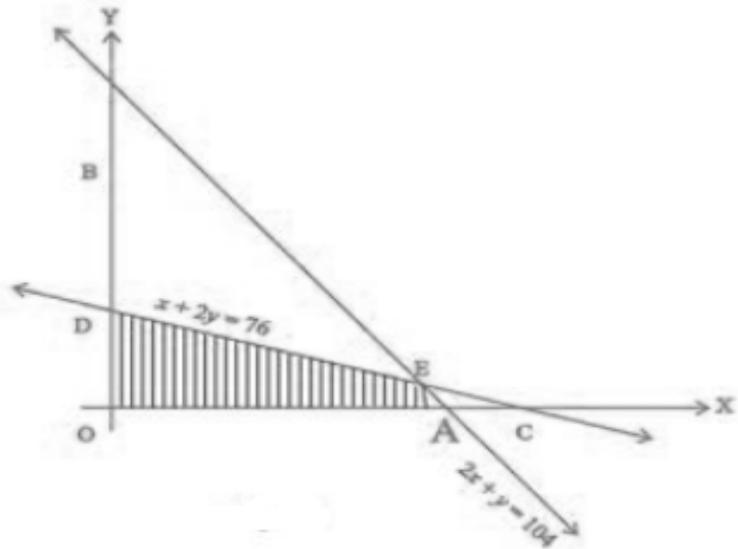
Time allowed: 3 hours

General Instructions: Read the following instructions very carefully and strictly follow them:

SECTION A		
1	If $(2A - B) = \begin{bmatrix} 6 & -6 & 0 \\ -4 & 2 & 1 \end{bmatrix}$ and $(2B + A) = \begin{bmatrix} 3 & 2 & 5 \\ -2 & 1 & -7 \end{bmatrix}$ then $A = ?$ (A) $\begin{bmatrix} 4 & 2 & 1 \\ -2 & 3 & -1 \end{bmatrix}$ (B) $\begin{bmatrix} -3 & 2 & 1 \\ 2 & 1 & -1 \end{bmatrix}$ (C) $\begin{bmatrix} 3 & 2 & -1 \\ 2 & -1 & 1 \end{bmatrix}$ (D) $\begin{bmatrix} 3 & -2 & 1 \\ -2 & 1 & -1 \end{bmatrix}$	[1]
2	If $\Delta(x) = \begin{vmatrix} \sin \frac{x}{2} & 1 & 1 \\ 1 & \sin \frac{x}{2} & -\sin \frac{x}{2} \\ -\sin \frac{x}{2} & 1 & -1 \end{vmatrix}$ for all $x \in [0, \pi]$ then (A) The range of $\Delta(x)$ is $[2, 4]$ (B) The range of $\Delta(x)$ is $[-4, 2]$ (C) $\Delta(x)$ is not defined (D) None of these	[1]
3	If a matrix A is such that $3A^3 + 2A^2 + 5A + I = 0$, then A^{-1} is equal to (A) $3A^2 - 2A - 5$ (B) $3A^2 + 2A + 5$ (C) none of these (D) $-(3A^2 + 2A + 5I)$	[1]
4	If $f(x) = \begin{cases} \frac{\sqrt{1+kx} - \sqrt{1-kx}}{x}, & \text{for } -1 \leq x < 0 \\ 2x^2 + 3x - 2, & \text{for } 0 \leq x \leq 1 \end{cases}$ is continuous at $x = 0$, then k is equal to (A) - 3 (B) - 2 (C) - 4 (D) - 1	[1]
5	The direction ratios of a line parallel to z - axis are: a) $\langle 0, 0, 0 \rangle$ b) $\langle 1, 1, 1 \rangle$ c) $\langle 0, 0, 1 \rangle$ d) $\langle 1, 1, 0 \rangle$	[1]
6	The degree of the differential equation: $x^2 \frac{d^2y}{dx^2} = \left(x \frac{dy}{dx} - y\right)^3$ is:	[1]

	(A) 2 (B) 1 (C) 6 (D) 3	
7	<p>The corner points of the shaded unbounded feasible region of an LPP are (0, 4), (0.6, 1.6) and (3, 0) as shown in the figure. The minimum value of the objective function $Z = 4x + 6y$ occurs at</p>  <p>(A) (0.6, 1.6) and (3, 0) only (B) (0.6, 1.6) only (C) at every point of the line segment joining the points (0.6, 1.6) and (3, 0) (D) (3, 0) only</p>	[1]
8	<p>The vectors $2\hat{i} + 3\hat{j} - 4\hat{k}$ and $a\hat{i} + b\hat{j} + c\hat{k}$ are perpendicular, if</p> <p>a) $a = 2, b = 3, c = -4$ b) $a = -4, b = 4, c = -5$ c) $a = 4, b = 4, c = -5$ d) $a = 4, b = 4, c = 5$</p>	[1]
9	<p>$\int \frac{x + \sin x}{1 + \cos x} dx$ is equal to</p> <p>(A) $x - \tan \frac{x}{2} + C$ (B) $\log x + \sin x + C$ (C) $\log 1 + \cos x + C$ (D) $x \cdot \tan \frac{x}{2} + C$</p>	[1]
10	<p>Let $A = \begin{vmatrix} a & h & g \\ h & b & f \\ g & f & c \end{vmatrix}$, then</p> <p>(A) $A^T = -A$ (B) $A^T = A$ (C) $A^T = I$ (D) $A^T = IA$</p>	[1]
11	<p>The optimal value of the objective function is attained at the points</p> <p>(A) given by intersection of inequations with the axes only (B) given by intersection of inequations with y - axis only (C) given by intersection of inequations with x - axis only (D) given by corner points of the feasible region</p>	[1]
12	<p>In a hexagon ABCDEF $\vec{AB} = \vec{a}, \vec{BC} = \vec{b}$ and $\vec{CD} = \vec{c}$. Then $\vec{AE} =$</p> <p>(A) $\vec{a} + 2\vec{b} + 2\vec{c}$ (B) $\vec{b} + \vec{c}$ (C) $\vec{a} + \vec{b} + \vec{c}$ (D) $2\vec{a} + \vec{b} + \vec{c}$</p>	[1]
13	<p>For any 2×2 matrix, If $A(\text{adj } A) = \begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$, then A is equal to</p> <p>(A) 100 (B) 20 (C) 10 (D) 0</p>	[1]
14	<p>A speaks truth in 75% cases and B speaks truth in 80% cases. Probability that they contradict each other in a statement is</p> <p>(A) $\frac{13}{20}$ on (B) $\frac{3}{5}$ (C) $\frac{7}{20}$ (D) $\frac{2}{5}$</p>	[1]
15	<p>The integrating factor of the differential equation $\cos x \frac{dy}{dx} + y \sin x = 1$ is</p> <p>(A) $\sin x$ (B) $\sec x$ (C) $\tan x$ (D) $\cos x$</p>	[1]
16	<p>The position vectors of three consecutive vertices of a parallelogram ABCD are $A(4\hat{i} + 2\hat{j} - 6\hat{k})$, $B(5\hat{i} - 3\hat{j} + \hat{k})$ and $C(12\hat{i} + 4\hat{j} + 5\hat{k})$. The position vector of D is given by</p> <p>(A) $-11\hat{i} - 9\hat{j} + 2\hat{k}$ (B) $-3\hat{i} - 5\hat{j} - 10\hat{k}$ (C) $11\hat{i} + 9\hat{j} - 2\hat{k}$ (D) $21\hat{i} + 3\hat{j}$</p>	[1]
17	<p>If $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \dots}}} \infty$ then $\frac{dy}{dx} = ?$</p>	[1]

	(A) $\frac{\sin x}{(2y+1)}$	(B) $\frac{\sin x}{(2y-1)}$	(C) $\frac{\cos x}{(2y-1)}$	(D) $\frac{\cos x}{(y-1)}$	
18	The angle between the lines $\frac{x+1}{1} = \frac{4-y}{-1} = \frac{z-5}{2}$ and $\frac{x+3}{-3} = \frac{y-2}{5} = \frac{z+5}{4}$ is:				[1]
	(A) $\frac{\pi}{4}$	(B) $\cos^{-1}\left(\frac{2}{3}\right)$	(C) $\frac{\pi}{2}$	(D) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$	
19	<p>Assertion ((A): If the circumference of the circle is changing at the rate of 10 cm/s, then the area of the circle changes at the rate 30 cm²/s, if radius is 3 cm.</p> <p>Reason (R): If A and r are the area and radius of the circle, respectively, then rate of change of area of the circle is given by $\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$.</p> <p>(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.</p>				[1]
20	<p>Assertion ((A): The Greatest Integer Function $f: \mathbb{R} \rightarrow \mathbb{R}$, given by $f(x) = [x]$ is one - one.</p> <p>Reason (R): A function $f: A \rightarrow B$ is said to be injective if $f(A) = f(B) \Rightarrow a = b$.</p> <p>(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.</p>				[1]
Section B					
21	Evaluate: $-\tan^{-1}\left(-\frac{1}{\sqrt{3}}\right) - \cot^{-1}\left(\frac{1}{\sqrt{3}}\right) + \tan^{-1}\left(\sin\left(-\frac{\pi}{2}\right)\right)$ OR Write the interval for the principal value of function and draw its graph: $\tan^{-1} x$.				[2]
22	Find the absolute maximum and the absolute minimum values of the function $f(x) = (x - 2)\sqrt{x - 1}$ in the given interval [1, 9].				[2]
23	A particle moves along the curve $6y = x^3 + 2$. Find the points on the curve at which the y - coordinate is changing 2 times as fast as x - coordinates. OR It is given that $x = 2$, the function $x^3 - 12x^2 + kx - 8$ attains maximum value, on the interval [0, 3]. Find the value of k.				[2]
24	Integrate the function: $\frac{2\cos x - 3\sin x}{6\cos x + 4\sin x}$				[2]
25	Show that $f(x) = (x - 1)e^x + 1$ is an increasing function for all $x > 0$.				[2]
Section C					
26	Evaluate the integral: $\int \frac{\sin x}{\cos 2x} dx$. OR Evaluate: $\int \frac{(2x+1)}{(4-3x-x^2)} dx$				[3]
27	Evaluate: $\int_0^{\frac{\pi}{2}} (2\log \cos x - \log \sin 2x) dx$				[3]
28	Find the particular solution of the differential equation: $\frac{dy}{dx} = \frac{x(2 \log x + 1)}{\sin y + y \cos y}$, given that $y = \frac{\pi}{2}$, when $x = 1$. OR Solve the following differential equation: $x^2 dy = (x^2 - 2y^2 + xy) dx$.				[3]
29	Solve the following linear programming problem graphically: Minimise: $Z = x + 2y$ subject to the constraints: $x + 2y \geq 100$, $2x - y \leq 0$, $2x + y \leq 200$ and $x \geq 0$, $y \geq 0$.				[3]

	OR	
	Determine the maximum value of $Z = 3x + 4y$ for the feasible region (shaded) for an LPP shown in Fig.	
		
30	Three persons A, B and C apply for a job of manager in a private company. Chances of their selection are in the ratio 1 : 2 : 4. The probability that A, B and C can introduce changes to increase the profits of a company are 0.8, 0.5 and 0.3 respectively. If increase in the profit does not take place, find the probability that it is due to the appointment of A.	[3]
31	Find the value of $\frac{dy}{dx}$ at $\theta = \frac{\pi}{4}$, if $x = ae^{\theta}(\sin\theta - \cos\theta)$ and $y = ae^{\theta}(\sin\theta + \cos\theta)$.	[3]
	Section D	
32	Find the area bounded by the curve $\frac{x^2}{16} + \frac{y^2}{9} = 1$ bounded by the lines $y = 0$ and $y = 2$ using integration.	[5]
33	Let n be a fixed positive integer. Define a relation R in Z as follows: For all $a, b \in Z$ $a R b$ if and only if $a - b$ is divisible by n . Show that R is an equivalence relation. OR Let $A = R - \{3\}$ and $B = R - \{1\}$. Define a function $f : A \rightarrow B$ by $f(x) = \frac{x-2}{x-3}$. Is f one to one? Justify your answer.	[5]
34	Show that the lines $\vec{r} = (2\hat{i} - 3\hat{k}) + \lambda(\hat{i} + 2\hat{j} + 3\hat{k})$ and $\vec{r} = (\hat{i} - \hat{j} - 4\hat{k}) + \mu(\hat{2}\hat{i} + 3\hat{j} + 4\hat{k})$ intersect. Also, find their point intersection. OR Find the distance of a point $(2, 4, -1)$ from the line $\frac{x+5}{1} = \frac{y+3}{4} = \frac{z-6}{-9}$.	[5]
35	Given $A = \begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}$ find AB and use this result in solving the following system of equations. $x - y + z = 4$ $x - 2y - 2z = 9$ $2x + y + 3z = 1$.	[5]
	Section E	
36	Read the following text carefully and answer the questions that follow: Mr. Ajay is taking up subjects of mathematics, physics, and chemistry in the examination. His probabilities of getting a grade A in these subjects are 0.2, 0.3, and 0.5 respectively. 	[4]

	<ol style="list-style-type: none"> 1. Find the probability that Ajay gets Grade A in all subjects. (1) 2. Find the probability that he gets Grade A in no subjects. (1) 3. Find the probability that he gets Grade A in two subjects. (2) <p style="text-align: center;">OR</p> <p>Find the probability that he gets Grade A in at least one subject. (2)</p>	
37	<p>Read the following text carefully and answer the questions that follow:</p> <p>A helicopter starts at an initial point A(1, 2, -1) and travels to point B(3, 1, 4). A tower is located at point C(-1, 3, 2). All coordinates are in kilometers.</p> <div style="text-align: center;">  </div> <ol style="list-style-type: none"> 1. Write the displacement vector representing the helicopter's path from A to B. (1) 2. Find the area of the triangle formed by the points A, B, and C. (1) 3. Determine the unit vector in the direction of \vec{AC}. (2) <p style="text-align: center;">OR</p> <p>Find a vector that is perpendicular to both \vec{AB} and \vec{AC}. (2)</p>	[4]
38	<p>Read the following text carefully and answer the questions that follow:</p> <p>A tin can manufacturer designs a cylindrical tin can for a company making sanitizer and disinfectors. The tin can is made to hold 3 litres of sanitizer or disinfectant. The cost of material used to manufacture the tin can is ₹ 100/m².</p> <div style="text-align: center;">  </div> <ol style="list-style-type: none"> 1. If r cm be the radius and h cm be the height of the cylindrical tin can, then express the surface area as a function of radius (r)? (1) 2. Find the radius of the can that will minimize the cost of tin used for making can? (1) 3. Find the height that will minimize the cost of tin used for making can? (2) <p style="text-align: center;">OR</p> <p>Find the minimum cost of material used to manufacture the tin can. (2)</p>	[4]
