

Kalyani  
20.12

**CARMEL CONVENT SCHOOL, CHANDIGARH**  
**PREBOARD EXAMINATION 2025-2026**  
**MATHEMATICS**

**CLASS: XII**  
**DATE: 12.12.2025**

**TOTAL MARKS: 80**  
**TIME: 3 HOURS**

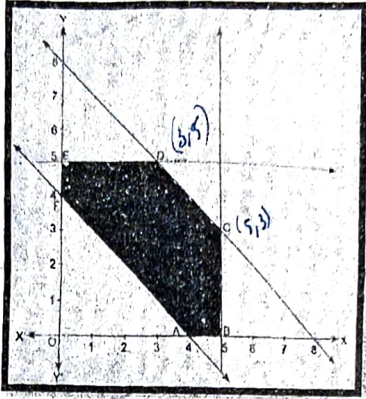
**General Instructions:**

- (i) All questions are compulsory.
- (ii) The question paper has five sections: A, B, C, D and E.  
Section-A has 20 questions (Q1 to 20) of 1 mark each.  
Section-B has 5 questions (Q21 to 25) of 2 marks each.  
Section-C has 6 questions (Q26 to 31) of 3 marks each.  
Section D has 4 questions (Q32 and 35) of 5 marks each.  
Section-E has 3 Case Study questions (Q36 to 38) of 4 marks each.
- (iii) All questions are compulsory. There is no overall choice. However, internal choices have been provided in some questions. A student must attempt only one of the alternatives in such questions.
- (iv) Draw neat figures wherever required.

**SECTION A**

Q. No.	Question	Marks
1	If A and B are square matrices of same order such that $AB = A$ and $BA = B$ , then $A^2 + B^2$ is equal to a) $A+B$ b) $BA$ c) $2(A+B)$ d) $2BA$	1
2	If $A = [a_{ij}]$ is a square matrix of order $3 \times 3$ and $ A  = -5$ , then find the value of $a_{11}A_{21} + a_{12}A_{22} + a_{13}A_{23}$ where $A_{ij}$ is the cofactor of an element $a_{ij}$ . a) 0 b) 1 c) 2 d) 3	1
3	The angle between vectors $\vec{a}$ and $\vec{b}$ if $ \vec{a}  = 1$ , $ \vec{b}  = 2$ and $\vec{a} \times \vec{b} = \hat{i} + \hat{j} + \hat{k}$ is a) $\frac{\pi}{3}$ b) $\frac{-\pi}{3}$ c) $\frac{\pi}{6}$ d) $\frac{-\pi}{6}$	1
4	For what value of k, the function $f(x) = 3x - 2$ , if $0 < x < 1$ and $f(x) = 2 + ax$ , if $1 < x < 2$ is continuous for x belonging to $(0,2)$ , then a is equal to ? a) -4	1

	b)-7/2 c)-2 d)-1	
5	Solution of the differential equation $\frac{dy}{dx} = \frac{-x}{y}$ represents family of: a) parabolas b) circles c) ellipses d) hyperbolas	1
6	If $\int e^{-2\log x} dx = f(x) + c$ , what is $f(x)$ ? a) $x$ b) $1/x$ c) $-1/x$ d) $x^2$	1
7	Analyse the function $f(x) =  x - 3 $ , $x \in \mathbb{R}$ at $x=3$ for continuity and differentiability and choose the correct option a) continuous and differentiable b) continuous but not differentiable c) not continuous but differentiable d) neither continuous nor differentiable	1
8	The sum of order and degree of the differential equation $\frac{d^2y}{dx^2} + 3\left(\frac{dy}{dx}\right)^3 = e^x$ a) 2 b) 3 c) 5 d) 4	1
9	A dice is thrown once. If the odd number turns up, then the probability that it shows a prime number is a) $\frac{1}{3}$ b) $\frac{2}{3}$ c) $\frac{1}{5}$ d) $\frac{5}{3}$	1
10	If $\begin{vmatrix} 2x & 5 \\ 8 & x \end{vmatrix} = \begin{vmatrix} 6 & -2 \\ 7 & 3 \end{vmatrix}$ , then the value of $x < 0$ is a) 6 b) -6 c) -5 d) -8	1
11	If A and B are 3x3 invertible matrices such that $\det(A) = 4$ and if $\det((AB)^{-1}) = 1/20$ , then $\det(B)$ is equal to a) $1/20$ b) $1/5$ c) 20 d) 5	1

12	<p>The direction cosines of a line passing through the points (0,1,2) and (4,4,8) are</p> <p>a) <math>\frac{1}{\sqrt{61}}, \frac{1}{\sqrt{61}}, \frac{1}{\sqrt{61}}</math>  b) <math>\frac{4}{\sqrt{61}}, \frac{3}{\sqrt{61}}, \frac{6}{\sqrt{61}}</math>  c) <math>\frac{4}{\sqrt{61}}, \frac{4}{\sqrt{61}}, \frac{8}{\sqrt{61}}</math>  d) <math>\frac{1}{\sqrt{61}}, \frac{-4}{\sqrt{61}}, \frac{-8}{\sqrt{61}}</math></p>	1
13	<p>The feasible solution for LPP is shown below.</p>  <p>If the optimum function is <math>Z = px + qy</math> where <math>p</math> and <math>q</math> are positive and <math>Z</math> attains same value at <math>C</math> and <math>D</math>, what is the relation between <math>p</math> and <math>q</math>.</p> <p>a) <math>p = q</math>  b) <math>p &gt; q</math>  c) <math>p &lt; q</math>  d) <math>q &gt; p</math></p>	1
14	<p>The area bounded by the curve <math>y = \frac{2}{x}</math>, the x-axis and between <math>x = 2</math> to <math>x = 4</math> is</p> <p>a) 2 sq units  b) -2 sq units  c) <math>\log 2</math> sq units  d) <math>2 \log 2</math> sq units</p>	1
15	<p>Find a vector of magnitude 3 in the direction of vector <math>2\vec{i} - \vec{j} + 2\vec{k}</math></p> <p>a) <math>2\vec{i} - \vec{j} + 2\vec{k}</math>  b) <math>2\vec{i} + \vec{j} + 2\vec{k}</math>  c) <math>2\vec{i} - \vec{j} - 2\vec{k}</math>  d) <math>2\vec{i} - 2\vec{j} + 2\vec{k}</math></p>	1
16	<p>If <math>A = \begin{bmatrix} 1 &amp; -2 &amp; 3 \\ -2 &amp; 4 &amp; 5 \end{bmatrix}</math> and <math>B = \begin{bmatrix} 2 &amp; 3 \\ 4 &amp; 5 \\ 2 &amp; 1 \end{bmatrix}</math>. What is the order of <math>AB</math>?</p> <p>a) <math>2 \times 3</math>  b) <math>3 \times 2</math>  c) <math>2 \times 2</math>  d) not defined</p>	1

17	Integrating factor of the differential equation $\frac{dx}{dy} = x+y$ is a) -1 b) 1 c) $e^{-x}$ d) $e^{-y}$	1
18	$\int \frac{1}{\sin^2 x \cos^2 x} dx$ a) $\tan x + \cot x + c$ b) $\tan x - \cot x + c$ c) $\sec x + \cos x + c$ d) $\sec x - \cos x + c$	1
19	<b>ASSERTION-REASON BASED QUESTIONS</b> In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices. (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  <b>ASSERTION:</b> The principal value of $\sin^{-1}\left(-\frac{1}{2}\right) + \cos^{-1}\left(\frac{-1}{2}\right) = \frac{\pi}{2}$ <b>REASON:</b> $\sin^{-1}(\theta) + \cos^{-1}(\theta) = \frac{\pi}{2}$	1
20	<b>ASSERTION:</b> If the lines $\frac{2x-3}{1} = \frac{y-3}{1} = \frac{4-z}{k}$ and $\frac{x-1}{k} = \frac{y-4}{2} = \frac{z-5}{-2}$ are perpendicular, then the value of k is $\frac{-4}{5}$ . <b>REASON:</b> If lines are parallel then direction ratios are proportional.	1

### SECTION - B

Q. No.	Question	Marks
21	Using principal value, evaluate the following: $\sin^{-1}\left(\frac{2\pi}{3}\right) + \cos^{-1}\left(\frac{2\pi}{3}\right)$ OR Find domain of $\sin^{-1} \sqrt{x-1}$	2
22	Find $\int \frac{2\cos x}{(1-\sin x)(2-\cos^2 x)} dx$	2
23	Evaluate $\int_0^{\pi} \frac{x \tan x}{\sec x \operatorname{cosec} x} dx$	2

24	Find the least value of $a$ so that the function $f(x) = 2x^2 - ax + 3$ , $x \geq 1$ is increasing on $[2, 4]$ .	2
<b>OR</b>		
An edge of a variable cube is increasing at the rate of 10 cm/ sec. How fast is the volume of the cube increasing when the edge is 5 cm long?		
25	Find the points of local maxima and local minima for the function $f(x) = \sin x - \cos x$ , where $0 < x < 2\pi$ . Also find the local maximum and local minimum values	2

**SECTION – C**

Q. No.	Question	Marks										
26	<p>The probability distribution of a random variable <math>X</math> is given by</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td><math>X</math></td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td><math>P(X)</math></td> <td><math>p</math></td> <td><math>p/3</math></td> <td><math>p/6</math></td> <td><math>p/12</math></td> </tr> </table> <p>i. Determine the value of <math>p</math>.            ii. Calculate <math>P(X \geq 1)</math>            iii. Calculate expectation of <math>X</math> i.e <math>E(X)</math>.</p> <p style="text-align: center;"><b>OR</b></p> <p>In a city, a survey was conducted among residents about their preferred mode of commuting. It was found that 50% people preferred using public transport, 35% preferred using a bicycle and 20% use both public transport and bicycle. If a person is selected at random. Find the probability that :</p> <p>i. The person uses only public transport            ii. The person uses a bicycle, given that they also use the public transport.            iii. The person uses neither public transport nor a bicycle.</p>	$X$	0	1	2	3	$P(X)$	$p$	$p/3$	$p/6$	$p/12$	3
$X$	0	1	2	3								
$P(X)$	$p$	$p/3$	$p/6$	$p/12$								
27	<p>Evaluate <math>\int_0^{\pi} \frac{x}{a^2 \cos^2 x + b^2 \sin^2 x} dx</math></p> <p style="text-align: center;"><b>OR</b></p> <p>Evaluate <math>\int_{-1}^3  x^3 - x  dx</math></p>	3										
28	<p>Find the particular solution of the differential equation <math>\frac{dy}{dx} = \frac{xy}{x^2 + y^2}</math> given that <math>y = 1</math>, when <math>x = 0</math></p> <p style="text-align: center;"><b>OR</b></p> <p>Solve the differential equation</p> <p><math>(1+x^2) \frac{dy}{dx} + 2xy - 4x^2 = 0</math> given that <math>x = 0, y = 0</math></p>	3										

29	Solve the following Linear Programming Problem graphically: Maximize $Z = 400x + 300y$ subject to $x + y \leq 200$ , $x \leq 40$ , $y \geq 20$ , $y \geq 0$	3
30	Evaluate $\int \frac{\tan x + \tan^3 x}{1 + \tan^3 x} dx$	3
31	If $x = a \cos \theta + b \sin \theta$ and $y = a \sin \theta - b \cos \theta$ , prove that $y^2 \frac{d^2 y}{dx^2} - x \frac{dy}{dx} + y = 0$ . <b>OR</b> If $\log(x^2 + y^2) = 2 \tan^{-1} \frac{y}{x}$ , show that $\frac{dy}{dx} = \frac{x+y}{x-y}$ .	3

**SECTION - D**

Q. No.	Question	Marks
32	Find the vector and cartesian equations of the line passing through the point $(1, 2, -4)$ and perpendicular to the two lines $\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7}$ and $\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$ <b>OR</b> Find the shortest distance between the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$	5
33	Show that the relation $R$ on set $A = \{1, 2, 3, 4, 5\}$ , given by $R = \{(a, b) :  a - b  \text{ is even}\}$ is an equivalence relation. Show that all the elements of $\{1, 3, 5\}$ are related to each other and all the elements of $\{2, 4\}$ are related to each other. But no element of $\{1, 3, 5\}$ is related to any element of $\{2, 4\}$ .	5
34	Using integration, find the area of the region $\{(x, y) : x^2 + y^2 \leq 1, x + y \geq 1, x \geq 0, y \geq 0\}$ <b>OR</b> Find : $\int \frac{dx}{(\sin x + \sin 2x)}$	5
35	If $A = \begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$ , find $A^{-1}$ . Using this solve the following system of equations: $x + 2y - 3z = -4$ ; $2x + 3y + 3z = 2$ ; $x + y - 2z = -3$	5

### Section E

Question number 36 to 38 are case based questions. Each question has two/ three sub parts.

Q. No.	Question	Marks
36	<p>Teams A,B,C went for playing a tug of war game. Teams A,B,C have attached a rope to a metal ring and is trying to pull the ring into their own area.</p> <div style="text-align: center;"> </div> <p>Team A pulls with force <math>F_1 = 6\hat{i} + 0\hat{j}</math>                      Team B pulls with force <math>F_2 = -4\hat{i} + 4\hat{j}</math>                      Team C pulls with force <math>F_3 = -3\hat{i} - 3\hat{j}</math></p> <p>(i) What is the magnitude of the force of team A?                      (ii) Which team will win the game?                      (iii) Find the magnitude of the resultant force exerted by the teams. <b>OR</b>                      In what direction is the ring getting pulled?</p>	4
37	<p>Sooraj wants to construct a rectangular garden using a brick wall on one side of the garden and wire fencing for the other three sides as shown in the figure. He has 200 metres of fencing wire.</p> <div style="text-align: center;"> </div> <p>Based on the above information, answer the following questions</p> <p>(i) Let <math>x</math> metres denote the length of the side of the garden perpendicular to the brick wall and <math>y</math> metres denote the length of the side parallel to the brick wall. Determine the relation representing the total length of the fencing wire and also write <math>A(x)</math>, the area of the garden.                      (ii) Determine the maximum value of <math>A(x)</math>.</p>	4
38	<p>Some students are having a misconception while comparing decimals, for example, a student may mention that <math>78.56 &gt; 78.9</math> as</p>	4

$7856 > 789$ . In order to assess this concept, a decimal comparison test was administered to the students of class six, through the following question:

In the recently held sports day in the school 5 students participated in a javelin throw competition. The distances to which they have thrown the javelin are shown below in the table :

Name of student	Distance of javelin in meters
Ajay	47.7
Bijoy	47.07
Kartik	43.09
Dinesh	43.9
Devesh	45.2

The students were asked to identify who has thrown the javelin the farthest.

Based on the test attempted by the students, the teacher concludes that 40% of the students have the misconception in the concept of decimal comparison and the rest do not have misconception. 80% of the students having misconception answered Bijoy as the correct answer in the paper, 90% of the students who are identified with not having misconception did not answer Bijoy as their answer

On the basis of the above information, answer the following questions

- i. What is the probability of a student not having misconception, but still answers Bijoy in the test?
- ii. What is the probability that a randomly selected student answers Bijoy as his answer in the test?
- iii. What is the probability that a student who answered as Bijoy is having a misconception?

**OR**

What is a probability that a student who answered as Bijoy is amongst students who do not have misconception?

'The End''