CLASS 12

CBSE

PHYSICS WALLAH

12 SAMPLE QUESTION PAPERS

NEW PATTERN

As per Latest CBSE SQP (Dated 30th July, 2025)

MATHEMATICS

With CBSE SQP & 2025 Solved Paper

2026 EXAMINATION

Additional Features

- 13 Cheat Sheets (Mindmap)
- 3 SQPs with Handwritten Solutions

How to Rock Your Board Exams?

Admit Card: Double-check your admit card before heading to the exam center.

Stationary: Bring pens, pencils, erasers, sharpeners, ruler, and a geometry box. Ensure working pens with sufficient ink and carry spares.

Water bottle and wrist watch: Bring a transparent water bottle for hydration and a wrist watch to monitor time; avoid digital watches which may not be permitted.

Arrive Early at the Examination Center: Arrive before your admit card's reporting time for smooth security checks and room location.

Read the Instructions carefully: Read the instructions of the paper carefully to know the format, marking and special guidelines. Ask the invigilator for any doubts about instructions.

Manage your Time: Assign time for each section/question based on allotted marks and adhere to it for effective time management.

Don't Panic: If you find the paper difficult, remember that everyone else is likely feeling the same way. Stay focused, do your best, and don't let anxiety take over.

Start with your Strengths: Start with your strongest section/question to boost confidence for tougher parts.

Answer clearly and neatly: Write neatly, use headings, subheadings, and bullets for clarity and fetching more marks. Start with margins on both sides. This sets a structured format for your answers.

Don't spend too much time on one question: If a question is challenging or time-consuming, move on and revisit it later if possible. Avoid getting stuck on a single question.

Use of HB pencil: HB pencils produce a relatively dark and easily readable mark. Try to use HB pencils while making diagrams in the exam.

Attempt all questions: Even if unsure, attempt all questions; there is no negative marking in CBSE exams.

SELF ASSESSMENT SHEET

Self-assessment plays a crucial role in exam preparation and offers several advantages:

- **Enhanced Self-awareness:** Self-assessment sheets help students gain a deeper understanding of their strengths and weaknesses across various subjects. Specific feedback on their performance provides valuable insights into areas of excellence and those that require improvement.
- **Focused Study:** These sheets provide clear guidance to students on where to direct their efforts. Identifying which questions to review, reattempt, or practice allows for more efficient and purposeful study sessions.
- **Targeted Improvement:** By categorizing questions into different categories (e.g., Easy, Revise, Reattempt), students can concentrate on areas that require the most attention. This targeted approach can result in significant improvements in their comprehension and performance.
- **Motivation:** Self-assessment sheets serve as a source of motivation for students. Observing their progress and understanding the steps needed for improvement can boost their motivation to work harder and achieve better results.
- **Reduced Exam Anxiety:** Having a clear understanding of their preparation progress helps reduce exam-related anxiety. Students feel more confident when they know what aspects to focus on, leading to a calmer and more effective exam experience.
- **Time Management:** Self-assessment sheets aid students in managing their study time more effectively. They can allocate more time to areas requiring extensive revision or reattempt while spending less time on topics they have already mastered.

Self-evaluation Instruction: After completing the test, evaluate it using the provided explanations. Use only a pencil to mark the evaluations (allowing for revisions and reattempts). Record the marks obtained in the Marks section and provide remarks in the Remarks column.

Remarks Abbreviations:

- **Easy (E):** Use for questions that you should find straightforward, indicating a good understanding and correct answers.
- **Revise (R):** Assign to questions where your response contains minor errors or gaps in understanding, suggesting the need for topic review.
- **Reattempt (RA):** Use for questions with incorrect responses, significant misconceptions, or a lack of understanding. Students receiving this remark should revisit the topic thoroughly, seek additional help if necessary, and attempt similar questions to enhance their grasp of the concept.

	SQP 1		SQP 2		SQP 3		SQP 4		SQP 5	
S.No.	Marks	Remarks	Marks	Remarks	Marks	Remarks	Marks	Remarks	Marks	Remarks
Q.1										
Q.2										
Q.3										
Q.4										
Q.5										
Q.6										
Q.7										
Q.8										
Q.9										
Q.10										
Q.11										
Q.12										
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Q.14										
Q.15										
Q.16										
Q.17										
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Q.24										
Q.25										
Q.26										
Q.27										
Q.28										
Q.29										
Q.30										
Q.31										
Q.32										
Q.33										
Q.34										
Q.35										
Q.36										
Q.37										
Q.38										
Total										

	SQP 6		SQP 7		SQP 8		SQP 9		SQP 10		CBSE SQP	CBSE 2025 paper
S.No.	Marks	Remarks	Marks	Remarks	Marks	Remarks	Marks	Remarks	Marks	Remarks	Remarks	Remarks
Q.1												
Q.2												
Q.3												
Q.4												
Q.5												
Q.6												
Q.7												
Q.8												
Q.9												
Q.10												
Q.11												
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Q.30												
Q.31												
Q.32												
Q.33												
Q.34												
Q.35												
Q.36												
Q.37												
Q.38												
Total												

Comparative Analysis

MATHEMATICS						
CHAPTERS	2024 Paper		2025 Paper		Sample Question Paper 2025-26	
	Question Typology	Total Marks	Question Typology	Total Marks	Question Typology	Total Marks
Relations and Functions	1 MCQ, 1 CASE-BASED	5	1 SA, 1 CASE-BASED	7	1 CASE - BASED	4
Inverse Trigonometric Functions	1 A/R, 1 VSA,	3	1 MCQ	1	1 MCQ, 1 A/R, 1 VSA	4
Matrices	4 MCQ, 1 LA,	9	5 MCQ	5	2 MCQ	2
Determinants	1 MCQ,	1	1 LA	5	3 MCQ, 1 LA	8
Continuity and Differentiability	2 MCQ, 1 VSA, 2 SA,	10	1 MCQ, 1 VSA, 1 SA	6	2 MCQ, 2 VSA, 1 SA	9
Application of Derivatives	2 MCQ, 1 VSA, 1 CASE-BASED	8	2 MCQ, 1 VSA, 1 CASE-BASED	8	1 MCQ, 1 SA, 1 CASE - BASED	8
Integrals	2 MCQ, 1 VSA, 1 SA,	7	1 MCQ, 1 VSA, 1 SA, 1 LA	11	2 MCQ, 1 VSA (OR), 1 LA	9
Application of Integrals	1 MCQ, 1 LA,	6	1 MCQ, 1 LA	6	1 SA, 1 VSA (OR)	3
Differential Equations	1 MCQ, 1 SA,	4	1 MCQ, 1 SA	4	1 MCQ, 1 LA	6
Vector Algebra	1 MCQ, 1 A/R, 1 SA,	5	4 MCQ, 1 VSA	6	2 MCQ, 1 A/R, 1VSA	5
Three Dimensional Geometry	2 MCQ, 1 VSA, 1 LA,	9	1 MCQ, 1 VSA, 1 LA	8	1 MCQ, 1 SA, 1 LA	9
Linear Programming	1 LA	5	2 MCQ, 1 SA	5	2 MCQ, 1 SA	5
Probability	1 MCQ, 1 SA, 1 CASE-BASED	8	1 MCQ, 1 SA, 1 CASE-BASED	8	1 MCQ, 1 SA, 1 CASE - BASED	8

CONTENTS

I. Cheat Sheets

II. Sample Question Papers

III. Explanations

IV. CBSE Solved Papers

CHAPTER-1
RELATIONS AND FUNCTIONS

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Cheat Sheet

RELATIONS AND FUNCTIONS

Relations

Type of Relations

Reflexive:
If $(a, a) \in R, \forall\ a \in A$.
i.e., $a\ R\ a, \forall\ a \in A$

Symmetric:
If $a\ R\ b \Rightarrow b\ R\ a, \forall\ a, b \in A$
i.e., if $(a, b) \in R \Rightarrow (b, a) \in R, \forall\ a, b \in A$

Transitive :
If $a\ R\ b$ and $b\ R\ c \Rightarrow a\ R\ c, \forall\ a, b, c \in A$ *i.e.* If $(a, b) \in R$ and $(b, c) \in R \Rightarrow (a, c) \in R, \forall\ a, b, c \in A$

Equivalence Relation:
A relation R on a non-empty set A is called an equivalence relation if and only if it is Reflexive, Symmetric as well as Transitive.

e.g.: Let T be the set of all triangles in a plane with R a relation in T given by $R=\{(T_1, T_2) : T_1$ is congruent to $T_2\}$. Show that R is an equivalence relation.

Sol: R is reflexive, since every triangle is congruent to itself.

Further, $(T_1, T_2) \in R \Rightarrow T_1$ is congruent to $T_2 \Rightarrow T_2$ is congruent to $T_1 \Rightarrow (T_2, T_1) \in R$. Hence, R is symmetric. Moreover, (T_1, T_2), $(T_2, T_3) \in R \Rightarrow T_1$ is congruent to T_2 and T_2 is congruent to $T_3 \Rightarrow T_1$ is congruent to $T_3 \Rightarrow (T_1, T_3) \in R$. Hence, R is transitive. Therefore, R is an equivalence relation.

Definition:
For any two non-empty sets A and B, every subset of $A \times B$ defines a relation from A to B and every relation from A to B is a subset of $A \times B$.

If $(a,b) \in R$, then $a\ R\ b$, $R \subseteq A \times B$

- If $(a, b) \in R$, then $a\ R\ b$ is read as 'a is related to b'.
- If $(a, b) \notin R$, then $a\ \not{R}\ b$ is read as 'a is not related to b'.

Functions

Definition:
Let A and B are two non-empty sets. A function f from set A to set B is a rule which associated each element of A to a unique element of B, denoted by $f : A \to B$

- Set A is called domain of function 'f'
- Set B is called co-domain of function 'f'

If element x of A corresponds to $y(\in B)$ under the function f, then we say that y is the image of x and write $f(x) = y$.

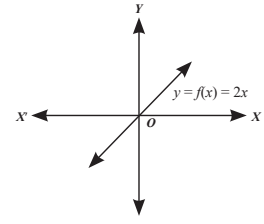
Types of Functions

Bijective Function:
A function $f : A \to B$, is both one-one and onto function, known as bijective function.

e.g.: Prove that the function $f : R \to R$, given by $f(x) = 2x$, is one-one and onto.

Sol: Let $f(x_1) = f(x_2) \Rightarrow 2x_1 = 2x_2 \Rightarrow x_1 = x_2$ therefore $f(x)$ is one-one Also, given any real number y in R, there exists $\frac{y}{2}$ in R such that

$f\left(\frac{y}{2}\right) = 2\left(\frac{y}{2}\right) = y$. Hence, f is onto.



One-one Function or Injective Function:
A function is said to be one-one function if different elements in a domain have different images in a co-domain.

If $f(x_1) = f(x_2)$ then $x_1 = x_2$, $f(x)$ is one - one function.

Many–one Function:
A function $f : A \to B$ is said to be many one if more than one element in set A have the same image in Set B.

Into Function:
A function $f : A \to B$ is said to be into function if there exists at least one element in set B having no pre-image in set A, is known as into function.

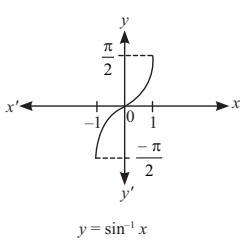
Onto or Surjective Function:
$f : A \to B$, said to be onto function if every element in set B has a pre-image in set A such that $f(x) = y$

i.e. Range of f = co-domain of f.

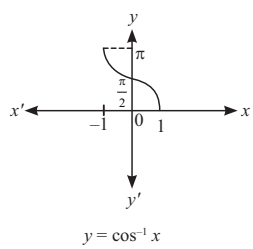
CHAPTER-2
INVERSE TRIGONOMETRIC FUNCTIONS

Cheat Sheet

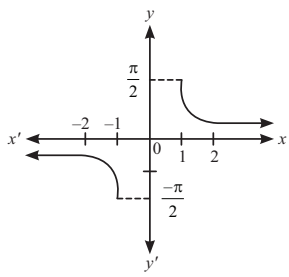
To Access One Shot Revision Video Scan This QR Code



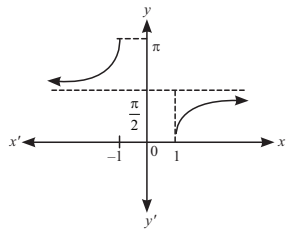
$y = \sin^{-1} x$



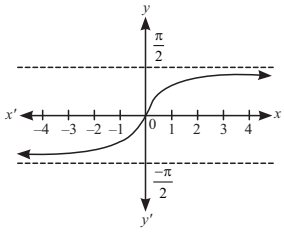
$y = \cos^{-1} x$



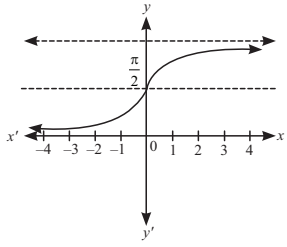
$y = \text{cosec}^{-1} x$



$y = \sec^{-1} x$:



$y = \tan^{-1} x$



$y = \cot^{-1} x$

Domain and Range of Inverse Trigonometric Functions

Function	Domain	Range
$\sin^{-1} x$	$[-1, 1]$	$\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$
$\cos^{-1} x$	$[-1, 1]$	$[0, \pi]$
$\tan^{-1} x$	$(-\infty, \infty)$	$\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$
$\cot^{-1} x$	$(-\infty, \infty)$	$(0, \pi)$
$\sec^{-1} x$	$R - (-1, 1)$	$[0, \pi] - \left\{\frac{\pi}{2}\right\}$
$\text{cosec}^{-1} x$	$R - (-1, 1)$	$\left[-\frac{\pi}{2}, \frac{\pi}{2}\right] - \{0\}$

Trigonometric Function

(i) $\sin x : R \to [-1, 1]$

(ii) $\cos x : R \to [-1, 1]$

(iii) $\tan x : R - \left\{x : x = (2n+1)\frac{\pi}{2}, n \in Z\right\} \to R$

(iv) $\cot x : R - \{x : x = n\pi, n \in Z\} \to R$

(v) $\sec x : R - \left\{x : x = (2n+1)\frac{\pi}{2}, n \in Z\right\} \to R - (-1, 1)$

(vi) $\text{cosec}\, x : R - \{x : x = n\pi, n \in Z\} \to R - (-1, 1)$

Graph of Inverse Trigonometric Function

INVERSE TRIGONOMETRIC FUNCTIONS

Some Important Properties

❑ **Property I:**

(*i*) $\sin^{-1}\frac{1}{x} = \text{cosec}^{-1} x,\ x \geq 1$ or $x \leq -1$

(*ii*) $\cos^{-1}\frac{1}{x} = \sec^{-1} x,\ x \geq 1$ or $x \leq -1$

(*iii*) $\tan^{-1}\frac{1}{x} = \cot^{-1} x,\ x > 0$

❑ **Property II:**

(*i*) $\sin^{-1}(\sin\theta) = \theta$, for all $\theta \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

(*ii*) $\cos^{-1}(\cos\theta) = \theta$, for all $\theta \in [0, \pi]$

(*iii*) $\tan^{-1}(\tan\theta) = \theta$, for all $\theta \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

(*iv*) $\text{cosec}^{-1}(\text{coses}\,\theta) = \theta$, for all $\theta \in \left[\frac{\pi}{2}, \frac{\pi}{2}\right], \neq 0$

(*v*) $\sec^{-1}(\sec\theta) = \theta$, for all $\theta \in [0, \pi], \theta \neq \frac{\pi}{2}$

(*vi*) $\cot^{-1}(\cot\theta) = \theta$, for all $\theta \in (0, \pi)$

❑ **Property III:**

(*i*) $\sin(\sin^{-1} x) = x$, for all $x \in [-1, 1]$

(*ii*) $\cos(\cos^{-1} x) = x$, for all $x \in [-1, 1]$

(*iii*) $\tan(\tan^{-1} x) = x$, for all $x \in R$

(*iv*) $\text{cosec}(\text{cosec}^{-1} x) = x$, for all $x \in (-\infty, -1] \cup [1, \infty)$

(*v*) $\sec(\sec^{-1} x) = x$, for all $x \in (-\infty, -1] \cup [1, \infty)$

(*vi*) $\cot(\cot^{-1} x) = x$, for all $x \in R$

❑ **Property IV:**

(*i*) $\sin^{-1}(-x) = -\sin^{-1} x,\ x \in [-1, 1]$

(*ii*) $\cos^{-1}(-x) = \pi - \cos^{-1} x,\ x \in [-1, 1]$

(*iii*) $\tan^{-1}(-x) = -\tan^{-1} x,\ x \in R$

(*iv*) $\text{cosec}^{-1}(-x) = -\text{cosec}^{-1} x,\ |x| \geq 1$

(*v*) $\sec^{-1}(-x) = \pi - \sec^{-1} x,\ |x| \geq 1$

(*vi*) $\cot^{-1}(-x) = \pi - \cot^{-1} x,\ x \in R$

❑ **Property V:**

(*i*) $\sin^{-1} x + \cos^{-1} x = \frac{\pi}{2}$, for all $x \in [-1, 1]$

(*ii*) $\tan^{-1} x + \cot^{-1} x = \frac{\pi}{2}$, for all $x \in R$

(*iii*) $\sec^{-1} x + \text{cosec}^{-1} x = \frac{\pi}{2}$, for all $x \in (-\infty, -1] \cup [1, \infty)$

❑ **Property VI:**

(*i*) $\tan^{-1} x + \tan^{-1} y = \tan^{-1}\frac{x+y}{1-xy},\ xy < 1$

(*ii*) $\tan^{-1} x - \tan^{-1} y = \tan^{-1}\frac{x-y}{1+xy},\ xy > -1$

(*iii*) $2\tan^{-1} x = \sin^{-1}\frac{2x}{1+x^2},\ |x| \leq 1$

(*iv*) $2\tan^{-1} x = \cos^{-1}\frac{1-x^2}{1+x^2},\ x \geq 0$

(*v*) $2\tan^{-1} = \tan^{-1}\frac{2x}{1-x^2},\ -1 < x < 1$

Roll No. | | | | | | | | |

Q.P. Code **01**

Candidates must write the Q.P. Code on the title page of the answer-book.

SAMPLE QUESTION PAPER- I

MATHEMATICS

Time allowed : 3 hours | Maximum Marks : 80

NOTE:

(i) Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

*(ii) Please check that this question paper contains **38** questions.*

*(iii) **Please write down the serial number of the question in the answer-book before attempting it.***

(iv) 15 minute time has been allotted to read this question paper. The students will read the question paper only and will not write any answer on the answer-book during this period.

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 number **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 **2 questions** in **Section E**.*

*(ix) Use of calculator is **NOT** allowed.*

SECTION - A

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

1. If A and B are symmetric of the same order, then $(AB' - BA')$ is a

(a) Skew symmetric matrix (b) Null matrix (c) Symmetric matrix (d) None of these

2. If A is a non-singular square matrix of order 3 such that $A^2 = 3A$, then value of $|A|$ is

(a) –4 (b) 3 (c) 9 (d) 27

3. If a line makes angles α, β and γ with the axes respectively, then $\cos 2\alpha + \cos 2\beta + \cos 2\gamma =$

(a) –2 (b) –1 (c) 1 (d) 2

4. If a function f defined by

$$f(x) = \begin{cases} \dfrac{k\cos x}{\pi - 2x'} & \text{if } x \neq \dfrac{\pi}{2} \\ 3 & \text{if } x = \dfrac{\pi}{2} \end{cases}$$

is continuous at $x = \dfrac{\pi}{2}$, then the value of k is

(a) 2 (b) 1 (c) 6 (d) 0

5. The unit vector parallel to the resultant vector of $2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\hat{i} + 2\hat{j} + 3\hat{k}$ is

(a) $\dfrac{1}{7}(3\hat{i} + 6\hat{j} - 2\hat{k})$ (b) $\dfrac{\hat{i} + \hat{j} + \hat{k}}{\sqrt{3}}$ (c) $\dfrac{\hat{i} + \hat{j} + 2\hat{k}}{\sqrt{6}}$ (d) $\dfrac{1}{\sqrt{69}}(-\hat{i} - \hat{j} + 8\hat{k})$

6. If $\sin x$ is an integrating factor of the differential equation $\dfrac{dy}{dx} + Py = Q$ then P can be

(a) $\log \sin x$ (b) $\cot x$ (c) $\sin x$ (d) $\log \cos x$

7. The position of points O (0, 0) and P (2, –2) in the region of graph of inequation $2x - 3y < 5$, will be

(a) O inside and P outside (b) O and P both inside

(c) O and P both outside (d) O outside and P inside

8. If the position vectors of A and B are $\hat{i} + 3\hat{j} - 7\hat{k}$ and $5\hat{i} - 2\hat{j} + 4\hat{k}$ respectively, then the direction cosine of $\overrightarrow{AB}$ along y axis is

(a) $\dfrac{4}{\sqrt{162}}$ (b) $-\dfrac{5}{\sqrt{162}}$ (c) – 5 (d) 11

9. $\displaystyle\int \frac{dx}{4x^2 + 9} =$

(a) $\dfrac{1}{2}\tan^{-1}\left(\dfrac{2x}{3}\right) + c$ (b) $\dfrac{3}{2}\tan^{-1}\left(\dfrac{2x}{3}\right) + c$ (c) $\dfrac{1}{6}\tan^{-1}\left(\dfrac{2x}{3}\right) + c$ (d) $\dfrac{1}{6}\tan^{-1}\left(\dfrac{3x}{2}\right) + c$

10. Let $f(x) = \begin{vmatrix} x & -4 & 5 \\ 1 & 1 & -2 \\ 2 & x & 1 \end{vmatrix}$ then $f'(5)$ is equal to

(a) 40 (b) 26 (c) 1 (d) None of these

11. The coordinates of the point for minimum value of $Z = 7x - 8y$ subject to the constraints $x + y - 20 \leq 0$, $y \geq 5$, $x \geq 0$, $y \geq 0$ is

(a) (20, 0) (b) (15, 5) (c) (0, 5) (d) (0, 20)

12. If the vectors $3\hat{i} + \lambda\hat{j} + \hat{k}$ and $2\hat{i} - \hat{j} + 8\hat{k}$ are perpendicular, then λ is

(a) –14 (b) 7 (c) 14 (d) $\dfrac{1}{7}$

35. Find the intervals in which the function $f(x) = -2x^3 - 9x^2 - 12x + 1$ is

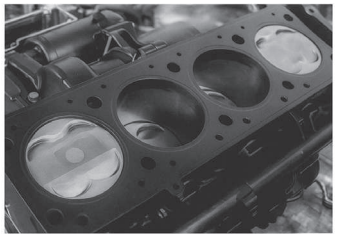
(i) strictly increasing (ii) strictly decreasing

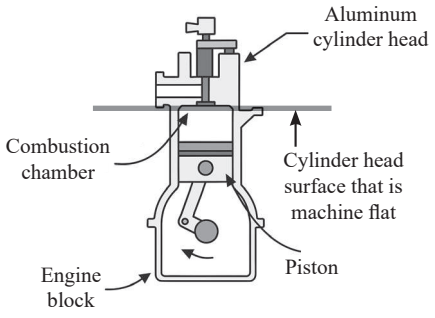
SECTION - E

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

36. Engine displacement is the measure of the cylinder volume swept by all the pistons of a piston engine. The piston moves inside the cylinder bore

One complete cycle of a four-cylinder four-stroke engine.
The volume displaced is marked





The cylinder bore in the form of circular cylinder open at the top is to be made from a metal sheet of area 75π cm^2.

Based on the above information, answer the following questions.

(i) If the radius of cylinder is r cm and height is h cm, then write the volume V of cylinder in terms of radius r. **1**

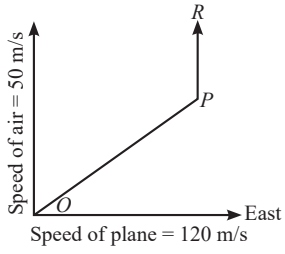
(ii) Find $\frac{dV}{dr}$ **1**

(iii) Find the radius of the cylinder when its volume is maximum. **2**

OR

For maximum volume, $h > r$. State true or false and justify.

37. A plane started from airport situated at O with a velocity of 120 m/s towards east. Air is blowing at a velocity of 50 m/s towards the north as shown in the figure.



The plane travelled 1 hr in OP direction with the resultant velocity. From P to R the plane travelled 1 hr keeping velocity of 120 m/s and finally landed at R.

Based on the above information, answer the following questions.

(i) What is the resultant velocity from O to P? **1**

(ii) What is the direction of travel of plane from O to P with East? **1**

(iii) What is the displacement from O to P? **2**

OR

What is the displacement from P to R?

SAMPLE QUESTION PAPER-I

(Explanations)

1. (*a*) $(AB' - BA')' = (AB')' - (BA')'$
$= (BA' - AB') = -(AB' - BA')$
Hence $AB' - BA'$ is skew symmetric matrix. ***(1 M)***

Mistakes 101 : What not to do!

Students do not understand how to apply the transpose of a matrix.

2. (*d*) $A^2 = 3A \Rightarrow |A^2| = |3A| \Rightarrow |A| \cdot |A| = 3^3 |A|$
($\because$ Order of matrix A is 3 and $|A|$ is not equal to zero).
$\Rightarrow |A| = 3^3 = 27 \Rightarrow |A| = 27$ ***(1 M)***

3. (*b*) Given α, β, γ are the angles made by line with the co-ordinate axes.
$\therefore l = \cos\alpha, m = \cos\beta, n = \cos\gamma.$
$\because l^2 + m^2 + n^2 = 1 \Rightarrow \cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$
Now $\cos^2\alpha + \cos^2\beta + \cos^2\gamma$
$= 2\cos^2\alpha - 1 + 2\cos^2\beta - 1 + 2\cos^2\gamma - 1$
$= 2(\cos^2\alpha + \cos^2\beta + \cos^2\gamma) - 3 = 2 \times 1 - 3$
$= 2 - 3 = -1$ ***(1 M)***

4. (*c*) Since, $f(x)$ is continuous at $x = \frac{\pi}{2}$

Therefore, $\lim\limits_{x \to \frac{\pi}{2}} f(x) = f\left(\frac{\pi}{2}\right)$

$$\Rightarrow \lim_{x \to \frac{\pi}{2}} \frac{k\cos x}{\pi - 2x} = 3 \Rightarrow k \lim_{x \to \frac{\pi}{2}} \frac{\sin\left(\frac{\pi}{2} - x\right)}{2\left(\frac{\pi}{2} - x\right)} = 3$$

$$\Rightarrow \frac{k}{2} \lim_{x \to \frac{\pi}{2}} \frac{\sin\left(\frac{\pi}{2} - x\right)}{\left(\frac{\pi}{2} - x\right)} = 3 \Rightarrow \frac{k}{2} = 3 \Rightarrow k = 6$$ ***(1 M)***

5. (*a*) Let, $\vec{a} = 2\hat{i} + 4\hat{j} - 5\hat{k}, \vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$

Resultant $\vec{R} = \vec{a} + \vec{b} = (2\hat{i} + 4\hat{j} - 5\hat{k}) + (\hat{i} + 2\hat{j} + 3\hat{k})$

$\vec{R} = 3\hat{i} + 6\hat{j} - 2\hat{k}$

Unit Vector,

$$\hat{R} = \frac{\vec{R}}{|\vec{R}|} = \frac{3\hat{i} + 6\hat{j} - 2\hat{k}}{\sqrt{3^2 + 6^2 + (-2)^2}} = \frac{3\hat{i} + 6\hat{j} - 2\hat{k}}{\sqrt{49}}$$

$$\hat{R} = \frac{3\hat{i} + 6\hat{j} - 2\hat{k}}{7}$$ ***(1 M)***

6. (*b*) Since $\sin x$ is the I.F. of the differential equation

$$\frac{dy}{dx} + Py = Q$$

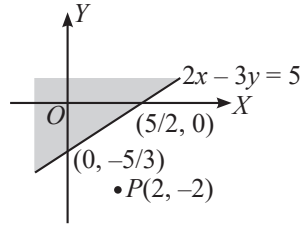
I.F. $= e^{\int P dx} = \sin x$

$$\Rightarrow \int P dx = \log\sin x \Rightarrow P = \frac{d}{dx}(\log\sin x)$$

$$\Rightarrow P = \frac{1}{\sin x} \times \frac{d}{dx}(\sin x) \Rightarrow P = \frac{1}{\sin x} \times \cos x$$

$\Rightarrow P = \cot x$ ***(1 M)***

7. (*a*)



Hence, O is inside and P is outside the region. ***(1 M)***

Nailing the Right Answer

Students should carefully draw the constraints and thoroughly examine the feasible and unfeasible regions.

8. (*b*) $\overrightarrow{AB} = 4\hat{i} - 5\hat{j} + 11\hat{k}$

Direction cosine along y–axis

$$= \frac{\overrightarrow{AB} \cdot \hat{j}}{|\overrightarrow{AB}|} = \frac{-5}{\sqrt{16 + 25 + 121}} = \frac{-5}{\sqrt{162}}.$$ ***(1 M)***

9. (*c*) $$\int \frac{dx}{4x^2 + 9} = \frac{1}{4}\int \frac{dx}{x^2 + \left(\frac{3}{2}\right)^2}$$

$$= \frac{1}{4} \cdot \frac{2}{3} \cdot \tan^{-1}\left(\frac{2x}{3}\right) + c = \frac{1}{6}\tan^{-1}\left(\frac{2x}{3}\right) + c.$$ ***(1 M)***

10. (*b*) $$f(x) = \begin{vmatrix} x & -4 & 5 \\ 1 & 1 & -2 \\ 2 & x & 1 \end{vmatrix} = x(1 + 2x) - 1(-4 - 5x) + 2(8 - 5)$$

$f(x) = x + 2x^2 + 4 + 5x + 6 = 2x^2 + 6x + 10$

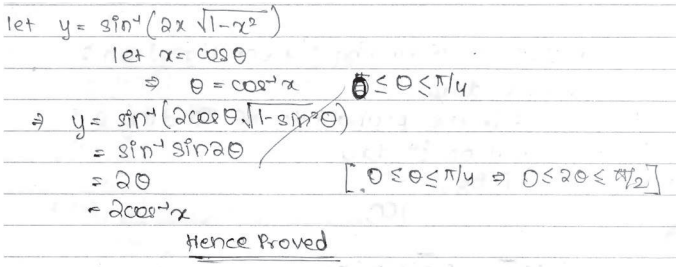
$\therefore \quad f'(x) = 4x + 6$

$\Rightarrow \quad f'(5) = 20 + 6 = 26$ ***(1 M)***

$\Rightarrow \quad -\frac{\pi}{4} \le \cos^{-1} x \le \frac{\pi}{4}$ **(½ M)**

$\Rightarrow \quad x \in \left[\frac{1}{\sqrt{2}}, 1\right]$ **(½ M)**

Topper's Explanation **(CBSE 2020)**



Mistakes 101 : What not to do!

Students often make mistakes by misapplying inverse trigonometric functions due to misunderstandings of their domain and range restrictions.

22. $f(x) = \begin{cases} x^2, & \text{if } x \ge 1 \\ x, & \text{if } x < 1 \end{cases}$

$f(x)$ is defined at $x = 1$ and $f(1) = 1$

$$f'(1^-) = \lim_{h \to 0} \frac{f(1-h) - f(1)}{-h} = \frac{1-h-1}{-h} = 1$$ **(1 M)**

$$f'(1^+) = \lim_{h \to 0} \frac{f(1+h) - f(1)}{h} = \lim_{h \to 0} \frac{(1+h)^2 - 1}{h}$$

$$= \lim_{h \to 0} \frac{h(2+h)}{h} = 2$$

$f'(1^-) \ne f'(1^+)$

Hence $f(x)$ is not differentiable at $x = 1$ **(1 M)**

23. (*a*) Given, $S = 6 + 48t - t^3$

$\therefore \quad V = \frac{dS}{dt} = 0 + 48 - 3t^2$ **(½ M)**

When it comes to rest, speed $(V) = 0$

$\therefore \quad 48 - 3t^2 = 0 \Rightarrow t = -4, 4$ **(½ M)**

Distance covered in 4 seconds is:

$(S)_4 = 6 + 192 - 64 = 134$ **(1 M)**

OR

(*b*) Let x be the length of a side, V be the volume and S be the surface area of the cube. Then, $V = x^3$ and $S = 6x^2$, where x is a function of time t.

Given, $\frac{dV}{dt} = 9$ cm^3/s

$\therefore \quad 9 = \frac{dV}{dt} = \frac{d}{dt}(x^3) = \frac{d}{dx}(x^3) \cdot \frac{dx}{dt} = 3x^2 \frac{dx}{dt}$

(By Chain Rule)

$\Rightarrow \quad \frac{dx}{dt} = \frac{3}{x^2}$ …(*i*) **(1 M)**

Now $\frac{dS}{dt} = \frac{d}{dt}(6x^2) = 12x \cdot \frac{dx}{dt}$ (By Chain Rule)

$= 12x \cdot \left(\frac{3}{x^2}\right) = \frac{36}{x}$ (Using equ. (*i*))

Hence, when $x = 6$ cm, $\frac{dS}{dt} = 6$ cm^2/s **(1 M)**

24. (*a*) Let $I = \int \frac{dx}{(a^2 + x^2)^{3/2}}$

Put $x = a \tan\theta \Rightarrow dx = a \sec^2\theta d\theta$ **(½ M)**

$\therefore \quad I = \int \frac{a \sec^2\theta}{(a^2 + a^2 \tan^2\theta)^{3/2}} d\theta = \int \frac{a \sec^2\theta}{a^3 (\sec^2\theta)^{3/2}} d\theta$ **(½ M)**

$\Rightarrow \quad I = \frac{1}{a^2} \int \frac{d\theta}{\sec\theta} = \frac{1}{a^2} \int \cos\theta \, d\theta = \frac{1}{a^2} \sin\theta + c$

$\Rightarrow \quad I = \frac{x}{a^2 (x^2 + a^2)^{1/2}} + c.$ **(1 M)**

OR

(*b*) Let $I = \int \frac{e^{m \tan^{-1} x}}{1 + x^2} dx$

Put $m \tan^{-1} x = t$

$\Rightarrow \quad \frac{m}{1 + x^2} dx = dt \quad \Rightarrow \quad \frac{dx}{1 + x^2} = \frac{dt}{m}$ **(1 M)**

$\therefore I = \frac{1}{m} \int e^t . dt = \frac{1}{m} e^t + c = \frac{1}{m} e^{m \tan^{-1} x} + c$ **(1 M)**

Nailing the Right Answer

Students should carefully choose a substitution variable that transforms the problem into a trigonometric identity in these types of problems.

25. The given function is $f(x) = 9x^2 + 12x + 2 = (3x + 2)^2 - 2$

It can be observed that $(3x + 2)^2 \ge 0$ for every $x \in R$.

Therefore, the minimum value of f is attained when $3x + 2 = 0$

$\Rightarrow x = \frac{-2}{3}$ **(1 M)**

$\therefore$ Minimum value of $f(x) = f\left(\frac{-2}{3}\right) = \left(3 \cdot \left(\frac{-2}{3}\right) + 2\right)^2 - 2 = -2.$

(1 M)

26. (*a*) Let $I = \int \frac{e^{-x}}{1 + e^x} dx = \int \frac{e^{-x} e^{-x}}{e^{-x} + 1} dx$

Put $e^{-x} + 1 = t \Rightarrow -e^{-x} dx = dt$, then it reduces to

CBSE SAMPLE QUESTION PAPER

(Issued by CBSE on 30th July, 2025)

Class-XII Session: 2025-26

MATHEMATICS (041)

Time allowed : 3 hours | Maximum Marks : 80

General Instructions:

Read the following instructions carefully and 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) with only one correct option 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.

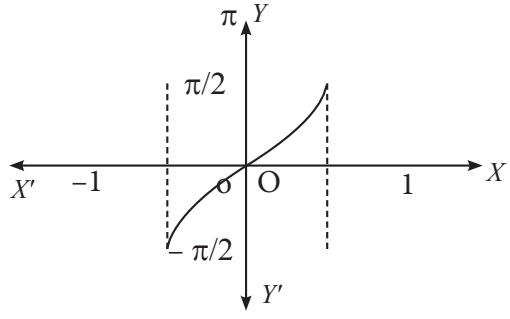
(ix) Use of calculator is not allowed.

SECTION - A

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

Select the correct option (Question 1 - Question 18)

1. Identify the function shown in the graph **1**



(*a*) $\sin^{-1}(x)$ (*b*) $\sin^{-1}(2x)$ (*c*) $\sin^{-1}\left(\frac{x}{2}\right)$ (*d*) $2\sin^{-1}(x)$

Sol. (*b*) Clearly from the graph Domain is $\left[-\frac{1}{2},\frac{1}{2}\right]$

So graph is of the function $\sin^{-1}(2x)$ **(*1 M*)**

2. If for three matrices $A=[a_{ij}]_{m\times 4}$, $B=[b_{ij}]_{n\times 3}$ and $C=[c_{ij}]_{p\times q}$ products AB and AC both are defined and are square matrices of same order, then value of m, n, p and q are: **1**

(*a*) $m = q = 3$ and $n = p = 4$ (*b*) $m = 2$, $q = 3$ and $n = p = 4$

(*c*) $m = q = 4$ and $n = p = 3$ (*d*) $m = 4$, $p = 2$ and $n = q = 3$

Sol. (*a*) AB is defined so $n = 4$

AC is defined so $p = 4$

AB and AC are square matrices of same order

so $m \times 3 = m \times q \Rightarrow q = 3 = m$

$m = q = 3$ and $n = p = 4$ **(*1 M*)**

3. If the matrix $A=\begin{bmatrix}0 & r & -2\\ 3 & p & t\\ q & -4 & 0\end{bmatrix}$ is skew-symmetric, then value of $\frac{q+t}{p+r}$ is... **1**

(*a*) –2 (*b*) 0 (*c*) 1 (*d*) 2

Sol. (*a*) As A is skew symmetric

So $p = 0$, $q = 2$, $r = -3$, $t = 4$

So $\frac{q+t}{p+r}=\frac{6}{-3}=-2$ **(*1 M*)**

4. If A is a square matrix of order 4 and $|\text{adj } A| = 27$ then A(adj A) is equal to **1**

(*a*) 3 (*b*) 9 (*c*) $3I$ (*d*) $9I$

Sol. (*c*) $|\text{adj } A| = 27$

$\Rightarrow |A|^3 = 27 = 3^3 \Rightarrow |\text{A}| = 3$

A(adj A) $= |A|\, I = 3I$ **(*1 M*)**

5. The inverse of the matrix $\begin{bmatrix}3 & 0 & 0\\ 0 & 2 & 0\\ 0 & 0 & 5\end{bmatrix}$ is... **1**

(*a*) $\begin{bmatrix}0 & 0 & 3\\ 0 & 2 & 0\\ 5 & 0 & 0\end{bmatrix}$ (*b*) $\begin{bmatrix}\frac{1}{3} & 0 & 0\\ 0 & \frac{1}{2} & 0\\ 0 & 0 & \frac{1}{5}\end{bmatrix}$ (*c*) $\begin{bmatrix}-\frac{1}{3} & 0 & 0\\ 0 & -\frac{1}{2} & 0\\ 0 & 0 & -\frac{1}{5}\end{bmatrix}$ (*d*) $\begin{bmatrix}-3 & 0 & 0\\ 0 & -2 & 0\\ 0 & 0 & -5\end{bmatrix}$

Sol. (*b*) Inverse of the matrix $\begin{bmatrix}3 & 0 & 0\\ 0 & 2 & 0\\ 0 & 0 & 5\end{bmatrix}=\begin{bmatrix}\frac{1}{3} & 0 & 0\\ 0 & \frac{1}{2} & 0\\ 0 & 0 & \frac{1}{5}\end{bmatrix}$ **(*1 M*)**

Sol. (*c*) The projection of the vector $\hat{i}+2\hat{j}+\hat{k}$ on the line

$\vec{r}=\left(3\hat{i}-\hat{j}\right)+\lambda\left(\hat{i}+2\hat{j}+3\hat{k}\right)$ is $\frac{1\times1+2\times2+1\times3}{\sqrt{1^2+2^2+3^2}}=\frac{8}{\sqrt{14}}$ units **(*1 M*)**

14. The distance of the point with position vector $3\hat{i}+4\hat{j}+5\hat{k}$ from the *y*-axis is **1**

(*a*) 4 units (*b*) $\sqrt{34}$ units (*c*) 5 units (*d*) $5\sqrt{2}$ units

Sol. (*b*) The distance of the point (*a, b, c*) from the y-axis is $\sqrt{a^2+c^2}$

So, the distance is $\sqrt{3^2+5^2}=\sqrt{34}$ units. **(*1 M*)**

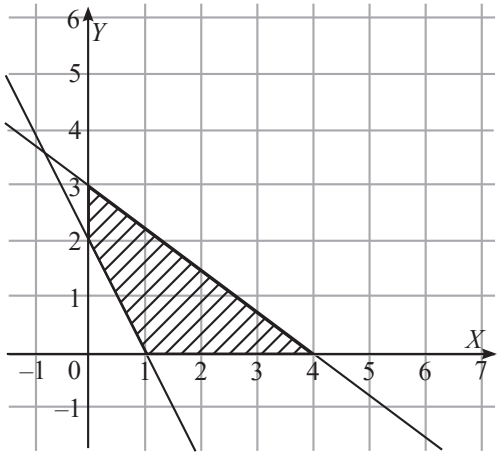
15. If $\vec{a}=3\hat{i}+2\hat{j}+4\hat{k},\vec{b}=\hat{i}+\hat{j}-3\hat{k}$ and $\vec{c}=6\hat{i}-\hat{j}+2\hat{k}$ are three given vectors, then $(2\vec{a}\cdot\hat{i})\hat{i}-(\vec{b}\cdot\hat{j})\hat{j}+(\vec{c}\cdot\hat{k})\hat{k}$ is same as the vector **1**

(*a*) $\vec{a}$ (*b*) $\vec{b}+\vec{c}$ (*c*) $\vec{a}-\vec{b}$ (*d*) $\vec{c}$

Sol. (*d*) $\left(2\vec{a}\cdot\hat{i}\right)\hat{i}-\left(\vec{b}\cdot\hat{j}\right)\hat{j}+\left(\vec{c}\cdot\hat{k}\right)\hat{k}=\left(2\times3\right)\hat{i}-\left(1\right)\hat{j}+\left(2\right)\hat{k}$

$=6\hat{i}-\hat{j}+2\hat{k}=\vec{c}$ **(*1 M*)**

16. A student of class XII studying Mathematics comes across an incomplete question in a book.
Maximise $Z = 3x + 2y + 1$
Subject to the constraints $x \geq 0$, $y \geq 0$, $3x + 4y \leq 12$,
He/ She notices the below shown graph for the said LPP problem, and finds that a constraint is missing in it:
Help him/her choose the required constraint from the graph.



The missing constraint is **1**

(*a*) $x + 2y \leq 2$ (*b*) $2x + y \geq 2$ (*c*) $2x + y \leq 2$ (*d*) $x + 2y \geq 2$

Sol. (*b*) The points (1, 0) and (0, 2) satisfy the equation $2x + y = 2$
And shaded region shows that (0,0) doesn't lie in the feasible solution region
So, the inequality is $2x + y \geq 2$ **(*1 M*)**

17. The feasible region of a linear programming problem is bounded but the objective function attains its minimum value at more than one point. One of the points is (5, 0).

How to Use This Book: A Simplified Guide

1. Gain a deep understanding of the most current exam trends through Comparative Analysis of CBSE SQP 2025-26, 2024 & 2025 Previous Year Papers.
2. Scan the provided QR code to access lecture videos. These will help you understand the core concepts of each chapter
3. Use the 'Cheat Sheets' for each chapter to refresh and reinforce your understanding.
4. Study the CBSE Past Year Paper 2025 and CBSE SQP. Understand the exam's structure, types of questions, marks distribution, word limits, and marking criteria.
5. Select the Sample Question Paper and solve it in a setting that mimics the actual exam environment.
6. Solve sample papers of varying difficulty levels - easy, medium, and hard. This ensures a well-rounded preparation.
7. After attempting each paper, use the self-assessment sheet to grade yourself and understand your performance.
8. Compare your answers with the explanations provided in the book. Pay special attention to sections like "Mistakes 101", "Nailing the Right Answers", and "Topper's Explanations" to learn from common mistakes and understand the best ways to answer questions.

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