CBSE CLASS XII · MATHEMATICS (041)

Chapter 2
Inverse Trigonometric Functions

Chapter-wise Previous Year Questions with Marking Scheme

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AN EDUCATIONAL INSTITUTE

Board Examinations 2022 – 2026 (including Compartment / Supplementary)

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Principal Value Branches & Principal Values

Multiple Choice Questions (1 mark)

Q1. **2025** : 65/2/1 **[1 Mark]**

If $y = \sin^{-1}x$, $-1 \le x \le 0$, then the range of y is

(A) $(-\frac{\pi}{2}, 0)$ (B) $[-\frac{\pi}{2}, 0]$

(C) $[-\frac{\pi}{2}, 0)$ (D) $(-\frac{\pi}{2}, 0]$

Ans. (B) $[-\frac{\pi}{2}, 0]$ **1**

Q2. **2025** : 65/2/2 **[1 Mark]**

The principal value of $\sin^{-1}(\cos\frac{43\pi}{5})$ is

(A) $-\frac{7\pi}{5}$ (B) $-\frac{\pi}{10}$

(C) $\frac{\pi}{10}$ (D) $\frac{3\pi}{5}$

Ans. (B) $-\frac{\pi}{10}$ **1**

Q3. **2025** : 65/4/1 **[1 Mark]**

The principal value of $\sin^{-1}(\sin(\frac{10\pi}{3}))$ is :

(A) $-\frac{2\pi}{3}$ (B) $-\frac{\pi}{3}$

(C) $\frac{\pi}{3}$ (D) $\frac{2\pi}{3}$

Ans. (C) $\frac{\pi}{3}$ **1**

Q4. **2025** : 65/4/2 **[1 Mark]**

The principal branch of $\cos^{-1}x$ is :

(A) $[\frac{\pi}{2}, \frac{3\pi}{2}]$ (B) $[\pi, 2\pi]$

(C) $[0, \pi]$ (D) $[2\pi, 3\pi]$

Ans. (C) $[0, \pi]$ **1**

Q5. **2025** : 65/5/1, 65/5/2, 65/5/3 **[1 Mark]**

The principal value of $\cot^{-1}(-\frac{1}{\sqrt{3}})$ is :

(A) $-\frac{\pi}{3}$ (B) $-\frac{2\pi}{3}$

(C) $\frac{\pi}{3}$ (D) $\frac{2\pi}{3}$

Ans. (D) $\frac{2\pi}{3}$ **1**

Q6. **2025 Supp** : 65/S/3 **[1 Mark]**

The principal value of $\cos^{-1}(-\frac{1}{\sqrt{2}})$ is :

(A) $\frac{\pi}{4}$ (B) $-\frac{\pi}{4}$

(C) $\frac{3\pi}{4}$ (D) $\frac{2\pi}{3}$

Ans. (C) $\frac{3\pi}{4}$ **1**

Q7. **2026** : 65/1/1 **[1 Mark]**

If $2\cos^{-1}x = y$, then

(A) $0 \le y \le \pi$ (B) $-\pi \le y \le \pi$

(C) $0 \le y \le 2\pi$ (D) $-\pi \le y \le 0$

Ans. (C) $0 \le y \le 2\pi$ **1**

Q8. **2026** : 65/1/2 **[1 Mark]**

If $\tan^{-1}x = 3y$, then

(A) $-\frac{\pi}{2} < y < \frac{\pi}{2}$ (B) $-\frac{3\pi}{2} < y < \frac{3\pi}{2}$

(C) $-\frac{\pi}{6} < y < \frac{\pi}{6}$ (D) $-\frac{\pi}{6} \le y \le \frac{\pi}{6}$

Ans. (C) $-\frac{\pi}{6} < y < \frac{\pi}{6}$ **1**

Q9. **2026** : 65/1/3 **[1 Mark]**

If $\sin^{-1}x + \pi = y$, then

(A) $-\frac{\pi}{2} \le y \le \frac{\pi}{2}$ (B) $-\frac{3\pi}{2} \le y \le -\frac{\pi}{2}$

(C) $\frac{\pi}{2} \le y \le \frac{3\pi}{2}$ (D) $0 \le y \le \pi$

Ans. (C) $\frac{\pi}{2} \le y \le \frac{3\pi}{2}$ **1**

Q10. **2026** : 65/3/1 **[1 Mark]**

The domain of $f(x) = \cos^{-1}(2x - 5)$ is :

(A) $[-1, 1]$ (B) $[4, 6]$

(C) $[-7, -3]$ (D) $[2, 3]$

Ans. (D) $[2, 3]$ **1**

Q11. **2026** : 65/4/1, 65/4/2, 65/4/3 **[1 Mark]**

The principal value of $\sec^{-1}(\sqrt{2}) + 2\,\text{cosec}^{-1}(-\sqrt{2})$ is :

(A) $-\frac{\pi}{2}$ (B) $-\frac{\pi}{4}$

(C) $\frac{\pi}{4}$ (D) $\frac{\pi}{2}$

Ans. (B) $-\frac{\pi}{4}$ **1**

Q12. **2026** : 65/5/1, 65/5/2, 65/5/3 **[1 Mark]**

For the inverse trigonometric functions, which of the following Principal Value Branch is ***not*** correctly defined ?

(A) $\tan^{-1} : \mathbb{R} \to (-\frac{\pi}{2}, \frac{\pi}{2})$

(B) $\sec^{-1} : \mathbb{R} - (-1, 1) \to [0, \pi] - \{\frac{\pi}{2}\}$

(C) $\cot^{-1} : \mathbb{R} \to (0, \pi)$

(D) $\text{cosec}^{-1} : \mathbb{R} - (-1, 1) \to [-\frac{\pi}{2}, \frac{\pi}{2}]$

Ans. (D) $\text{cosec}^{-1} : \mathbb{R} - (-1, 1) \to [-\frac{\pi}{2}, \frac{\pi}{2}]$ **1**

Q13. **2026 Supp** : 65/7/1, 65/7/3 **[1 Mark]**

The value of $\sin^{-1}(\sin \frac{3\pi}{5})$ is :

(A) $\frac{3\pi}{5}$

(B) $\frac{\pi}{5}$

(C) $\frac{7\pi}{5}$

(D) $\frac{2\pi}{5}$

Ans. (D) $\frac{2\pi}{5}$ **1**

Q14. **2026 Supp** : 65/7/1, 65/7/2 **[1 Mark]**

$[\tan^{-1}\sqrt{3} - \sec^{-1}(-2)]$ is equal to :

(A) π

(B) $-\frac{\pi}{3}$

(C) $\frac{\pi}{3}$

(D) $\frac{2\pi}{3}$

Ans. (B) $-\frac{\pi}{3}$ **1**

Q15. **2026 Supp** : 65/7/2 **[1 Mark]**

The value of $\cos^{-1}[\cos \frac{7\pi}{6}]$ is :

(A) $\frac{7\pi}{6}$

(B) $\frac{5\pi}{6}$

(C) $\frac{\pi}{3}$

(D) $\frac{\pi}{6}$

Ans. (B) $\frac{5\pi}{6}$ **1**

Assertion – Reason Questions (1 mark)

Q16. **2023** : 65/1/1, 65/1/3 **[1 Mark]**

Assertion (A) : The range of the function $f(x) = 2\sin^{-1}x + \frac{3\pi}{2}$, where $x \in [-1, 1]$, is $[\frac{\pi}{2}, \frac{5\pi}{2}]$.

Reason (R) : The range of the principal value branch of $\sin^{-1}(x)$ is $[0, \pi]$.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but 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.

Ans. (C) Assertion (A) is true, but Reason (R) is false. **1**

Q17. **2023** : 65/2/1, 65/2/2, 65/2/3 **[1 Mark]**

Assertion (A) : Maximum value of $(\cos^{-1}x)^2$ is π^2.

Reason (R) : Range of the principal value branch of $\cos^{-1}x$ is $[-\frac{\pi}{2}, \frac{\pi}{2}]$.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but 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.

Ans. (C) Assertion (A) is true, but Reason (R) is false. **1**

Q18. **2023** : 65/3/1, 65/3/2, 65/3/3 **[1 Mark]**

Assertion (A) : Range of $[\sin^{-1}x + 2\cos^{-1}x]$ is $[0, \pi]$.

Reason (R) : Principal value branch of $\sin^{-1}x$ has range $[-\frac{\pi}{2}, \frac{\pi}{2}]$.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but 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.

Ans. (D) Assertion (A) is false and Reason (R) is true. **1**

Q19. **2023** : 65/4/1, 65/4/2, 65/4/3 **[1 Mark]**

Assertion (A) : All trigonometric functions have their inverses over their respective domains.
Reason (R) : The inverse of $\tan^{-1}x$ exists for some $x \in \mathbb{R}$.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but 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.

Ans. (D) Assertion (A) is false and Reason (R) is true. **1**

Q20. **2023 Supp** : 65/C/1, 65/C/2, 65/C/3 **[1 Mark]**

Assertion (A) : The principal value of $\cot^{-1}(\sqrt{3})$ is $\frac{\pi}{6}$.

Reason (R) : Domain of $\cot^{-1}x$ is $\mathbb{R} - \{-1, 1\}$.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but 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.

Ans. (C) Assertion (A) is true, but Reason (R) is false. **1**

Q21. **2024** : 65/5/1, 65/5/2, 65/5/3 **[1 Mark]**

Assertion (A) : Domain of $y = \cos^{-1}(x)$ is $[-1, 1]$.

Reason (R) : The range of the principal value branch of $y = \cos^{-1}(x)$ is $[0, \pi] - \{\frac{\pi}{2}\}$.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but 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.

Ans. (C) Assertion (A) is true, but Reason (R) is false. **1**

Q22. **2024 Comptt** : 65/S/1, 65/S/2, 65/S/3 **[1 Mark]**

Assertion (A) : $\cos^{-1}(\cos \frac{13\pi}{6})$ is equal to $\frac{\pi}{6}$.

Reason (R) : The range of the principal value branch of the function $y = \cos^{-1}x$ is $[0, \pi]$.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but 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.

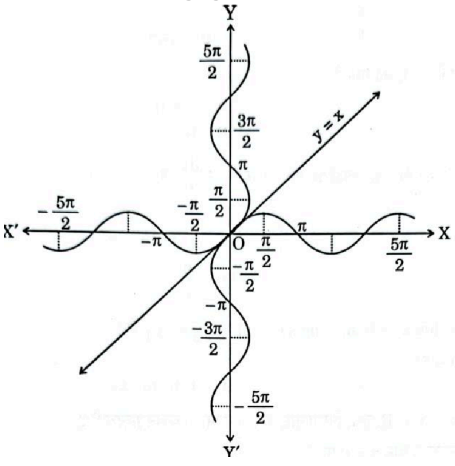
Ans. (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). **1**

Graphs of Inverse Trigonometric Functions

Multiple Choice Questions (1 mark)

Q23. **2025** : 65/6/1 **[1 Mark]**

The following graph is a combination of :

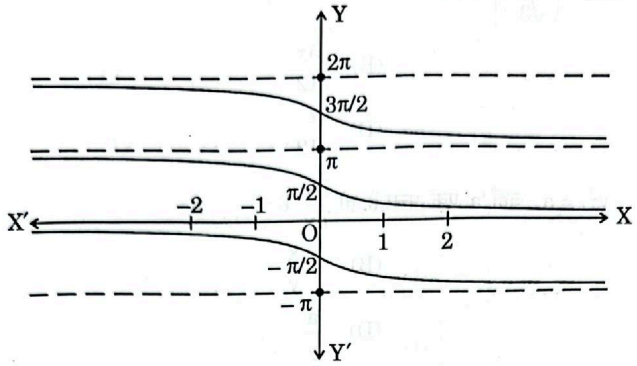


(A) $y = \sin^{-1}x$ and $y = \cos^{-1}x$
(B) $y = \cos^{-1}x$ and $y = \cos x$
(C) $y = \sin^{-1}x$ and $y = \sin x$
(D) $y = \cos^{-1}x$ and $y = \sin x$

Ans. (C) $y = \sin^{-1}x$ and $y = \sin x$ **1**

Q24. **2025** : 65/6/2 **[1 Mark]**

The graph shown below depicts :



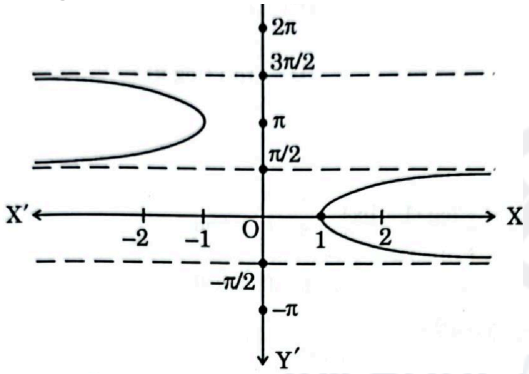
(A) $y = \cot x$ (B) $y = \cot^{-1}x$

(C) $y = \tan x$ (D) $y = \tan^{-1}x$

Ans. (B) $y = \cot^{-1}x$ **1**

Q25. **2025** : 65/6/3 **[1 Mark]**

The graph shown below depicts :



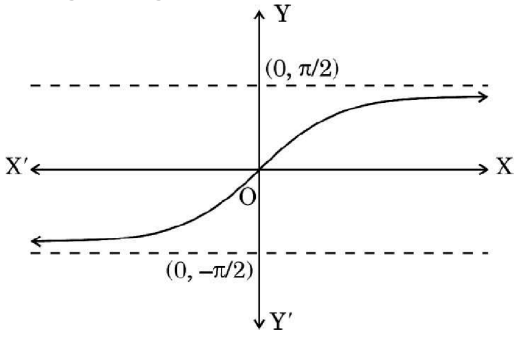
(A) $y = \sec^{-1}x$ (B) $y = \sec x$

(C) $y = \text{cosec}^{-1}x$ (D) $y = \text{cosec } x$

Ans. (A) $y = \sec^{-1}x$ **1**

Q26. **2025** : 65/7/1 **[1 Mark]**

The given graph illustrates :



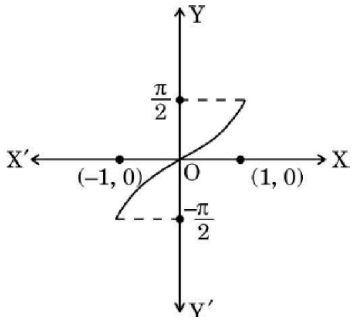
(A) $y = \tan^{-1}x$ (B) $y = \text{cosec}^{-1}x$

(C) $y = \cot^{-1}x$ (D) $y = \sec^{-1}x$

Ans. (A) $y = \tan^{-1}x$ **1**

Q27. **2025** : 65/7/2 **[1 Mark]**

Study the given graph. It illustrates :



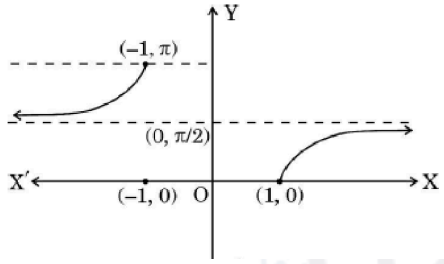
(A) $y = \tan^{-1}x$ (B) $y = \cos^{-1}x$

(C) $y = \sec^{-1}x$ (D) $y = \sin^{-1}x$

Ans. (D) $y = \sin^{-1}x$ **1**

Q28. **2025** : 65/7/3 **[1 Mark]**

The given graph illustrates :



(A) $y = \sec^{-1}x$ (B) $y = \cot^{-1}x$

(C) $y = \tan^{-1}x$ (D) $y = \text{cosec}^{-1}x$

Ans. (A) $y = \sec^{-1}x$ **1**

Domain & Range of Inverse Trigonometric Functions

Very Short Answer Questions (2 marks)

Q29. **2023** : 65/4/1, 65/4/2, 65/4/3 **[2 Marks]**

(a) Find the domain of $y = \sin^{-1}(x^2 - 4)$.

OR

(b) Evaluate : $\cos^{-1}[\cos(-\frac{7\pi}{3})]$

Answer (as per CBSE Marking Scheme)	Marks
(a) Domain of $\sin^{-1}x$ is $-1 \le x \le 1 \therefore -1 \le x^2 - 4 \le 1$ or $x^2 \ge 3, x^2 \le 5$	½
$\Rightarrow x \ge \sqrt{3}$ or $x \le -\sqrt{3}, x \le \sqrt{5}$ or $x \ge -\sqrt{5}$	1
$\therefore$ Domain is $[-\sqrt{5}, -\sqrt{3}] \cup [\sqrt{3}, \sqrt{5}]$	½
OR	
(b) $\cos^{-1}[\cos(-\frac{7\pi}{3})] = \cos^{-1}[\cos(\frac{7\pi}{3})]$	1
$= \cos^{-1}[\cos(2\pi + \frac{\pi}{3})]$	½
$= \cos^{-1}[\cos\frac{\pi}{3}] = \frac{\pi}{3}$	½

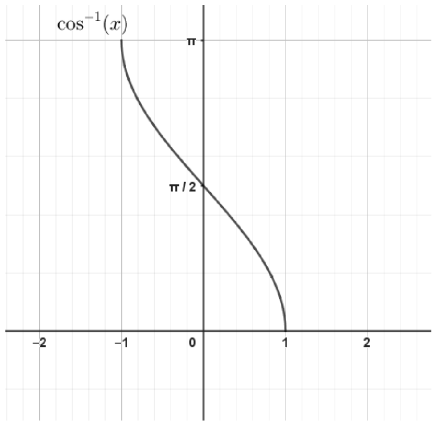
Q30. **2023** : 65/5/1 **[2 Marks]**

Write the domain and range (principle value branch) of the following functions : $f(x) = \tan^{-1}x$

Answer (as per CBSE Marking Scheme)	Marks
Domain = $\mathbb{R}$; Range = $(-\frac{\pi}{2}, \frac{\pi}{2})$	**1+1**

Q31. **2023** : 65/5/2 **[2 Marks]**

Draw the graph of the principal branch of the function $f(x) = \cos^{-1}x$.

Answer (as per CBSE Marking Scheme)	Marks
	**2**

Q32. **2025** : 65/5/1 **[2 Marks]**

Find the domain of the function $f(x) = \cos^{-1}(x^2 - 4)$.

Answer (as per CBSE Marking Scheme)	Marks
Domain of $\cos^{-1}x$ is $[-1, 1]$	**1**
$\Rightarrow -1 \le x^2 - 4 \le 1 \Rightarrow 3 \le x^2 \le 5$	**½**
$\Rightarrow x \in [-\sqrt{5}, -\sqrt{3}] \cup [\sqrt{3}, \sqrt{5}]$	**½**

Q33. **2025** : 65/5/2 **[2 Marks]**

Find the domain of $\sec^{-1}(2x + 1)$.

Answer (as per CBSE Marking Scheme)	Marks
Domain of $\sec^{-1}x$ is $(-\infty, -1] \cup [1, \infty)$	**1**
$\Rightarrow 2x + 1 \le -1$ or $2x + 1 \ge 1 \Rightarrow x \le -1$ or $x \ge 0$	**½**
$\Rightarrow$ Domain = $(-\infty, -1] \cup [0, \infty)$	**½**

Q34. **2025** : 65/5/3 **[2 Marks]**

Find the domain of $\sin^{-1}(x^2 - 3)$.

Answer (as per CBSE Marking Scheme)	Marks
Domain of $\sin^{-1}x$ is $[-1, 1]$	**1**
$-1 \le x^2 - 3 \le 1 \Rightarrow 2 \le x^2 \le 4$	**½**
$\Rightarrow$ Domain = $[-2, -\sqrt{2}] \cup [\sqrt{2}, 2]$	**½**

Q35. **2025** : 65/6/2 **[2 Marks]**

Find the domain of $f(x) = \sin^{-1}(-x^2)$.

Answer (as per CBSE Marking Scheme)	Marks
$-1 \le -x^2 \le 1 \Rightarrow -1 \le -x^2 \le 0$	**1**
$\Rightarrow 0 \le x^2 \le 1 \Rightarrow -1 \le x \le 1$	**1**

Long Answer Questions (5 marks)

Q36. **2026** : 65/2/1 **[5 Marks]**

Find the domain of $g(x) = \cos^{-1}(x^2 - 1)$. Hence, find the value of x for which $g(x) = \frac{\pi}{3}$. Also, write the range of $\cos^{-1}x$ other than its principal branch.

Answer (as per CBSE Marking Scheme)	Marks
Since domain of $\cos^{-1}x$ is $[-1, 1] \therefore -1 \le x^2 - 1 \le 1$	**1**
$\Rightarrow 0 \le x^2 \le 2 \Rightarrow -\sqrt{2} \le x \le \sqrt{2} \therefore$ Domain of $g(x) = [-\sqrt{2}, \sqrt{2}]$	**1**
When $g(x) = \frac{\pi}{3}$, we have $\cos^{-1}(x^2 - 1) = \frac{\pi}{3} \Rightarrow x^2 - 1 = \cos\frac{\pi}{3} = \frac{1}{2}$	**1**
$\Rightarrow x^2 = \frac{3}{2} \Rightarrow x = \sqrt{\frac{3}{2}}, -\sqrt{\frac{3}{2}}$	**1**
Range of $\cos^{-1}x$ other than its principal branch is $[-\pi, 0]$ or $[\pi, 2\pi]$. (Note: Any valid branch like $[2\pi, 3\pi]$, $[-2\pi, -\pi]$, ... etc. can be considered.)	**1**

Q37. **2026** : 65/2/2 **[5 Marks]**

Find the domain of $p(x) = \sin^{-1}(1 - 2x^2)$. Hence, find the value of x for which $p(x) = \frac{\pi}{6}$. Also, write the range of $2p(x) + \frac{\pi}{2}$.

Answer (as per CBSE Marking Scheme)	Marks
Since domain of $\sin^{-1}x$ is $[-1, 1] \therefore -1 \le 1 - 2x^2 \le 1$	**1**
$\Rightarrow -2 \le -2x^2 \le 0 \Rightarrow 0 \le x^2 \le 1 \Rightarrow -1 \le x \le 1 \therefore$ Domain of $p(x) = [-1, 1]$	**1**
When $p(x) = \frac{\pi}{6}$, we have $\sin^{-1}(1 - 2x^2) = \frac{\pi}{6} \Rightarrow 1 - 2x^2 = \sin\frac{\pi}{6} = \frac{1}{2}$	**1**
$\Rightarrow x^2 = \frac{1}{4} \Rightarrow x = \frac{1}{2}, -\frac{1}{2}$	**1**
Since range of $p(x) = \sin^{-1}(1 - 2x^2)$ is $[-\frac{\pi}{2}, \frac{\pi}{2}]$ i.e. $-\frac{\pi}{2} \le p(x) \le \frac{\pi}{2} \Rightarrow -\pi \le 2p(x) \le \pi \Rightarrow -\frac{\pi}{2} \le 2p(x) + \frac{\pi}{2} \le \frac{3\pi}{2}$. Hence the required range is $[-\frac{\pi}{2}, \frac{3\pi}{2}]$	**1**

Q38. **2026** : 65/2/3 **[5 Marks]**

Find the domain of $q(x) = \cos^{-1}(4x^2 - 3)$. Hence, find the value of x for which $q(x) = 0$. Also, write the range of $3q(x) - \pi$.

Answer (as per CBSE Marking Scheme)	Marks
Since domain of $\cos^{-1}x$ is $[-1, 1] \therefore -1 \le 4x^2 - 3 \le 1$	**1**
$\Rightarrow 2 \le 4x^2 \le 4 \Rightarrow \frac{1}{2} \le x^2 \le 1 \Rightarrow -1 \le x \le -\frac{1}{\sqrt{2}}$ or $\frac{1}{\sqrt{2}} \le x \le 1 \therefore$ Domain of $q(x) = [-1, -\frac{1}{\sqrt{2}}] \cup [\frac{1}{\sqrt{2}}, 1]$	**1**
When $q(x) = 0$, we have $\cos^{-1}(4x^2 - 3) = 0 \Rightarrow 4x^2 - 3 = \cos 0 = 1$	**1**
$\Rightarrow x^2 = 1 \Rightarrow x = 1, -1$	**1**

Since range of $q(x) = \cos^{-1}(4x^2 - 3)$ is $[0, \pi]$ i.e. $0 \le q(x) \le \pi \Rightarrow 0 \le 3q(x) \le 3\pi \Rightarrow -\pi \le 3q(x) - \pi \le 2\pi$. Hence the required range is $[-\pi, 2\pi]$.	**1**

Evaluating Expressions

Very Short Answer Questions (2 marks)

Q39. **2023** : 65/1/1, 65/1/2, 65/1/3 **[2 Marks]**

Evaluate : $\sin^{-1}(\sin \frac{3\pi}{4}) + \cos^{-1}(\cos \frac{3\pi}{4}) + \tan^{-1}(1)$

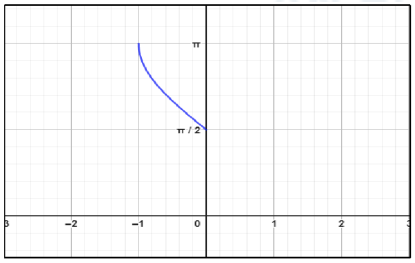
Answer (as per CBSE Marking Scheme)	Marks
Required value $= \frac{\pi}{4} + \frac{3\pi}{4} + \frac{\pi}{4}$	**1½**
$= \frac{5\pi}{4}$	**½**

Q40. **2023** : 65/2/1, 65/2/2, 65/2/3 **[2 Marks]**

(a) Evaluate $\sin^{-1}(\sin \frac{3\pi}{4}) + \cos^{-1}(\cos \pi) + \tan^{-1}(1)$.

OR

(b) Draw the graph of $\cos^{-1}x$, where $x \in [-1, 0]$. Also, write its range.

Answer (as per CBSE Marking Scheme)	Marks
(a) $\sin^{-1}(\sin \frac{3\pi}{4}) + \cos^{-1}(\cos \pi) + \tan^{-1}(1) = \frac{\pi}{4} + \pi + \frac{\pi}{4}$	**1½**
$= \frac{3\pi}{2}$	**½**
OR	
(b)  Correct Graph	**1**
Range : $[\frac{\pi}{2}, \pi]$	**1**

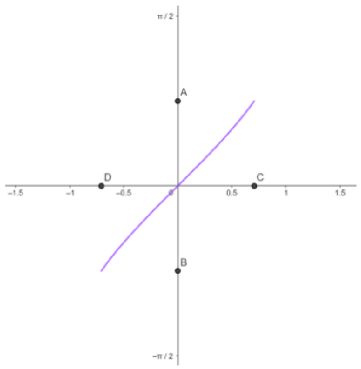
Q41. **2023** : 65/3/1, 65/3/2, 65/3/3 **[2 Marks]**

(a) Evaluate : $3 \sin^{-1}(\frac{1}{\sqrt{2}}) + 2 \cos^{-1}(\frac{\sqrt{3}}{2}) + \cos^{-1}(0)$

OR

(b) Draw the graph of $f(x) = \sin^{-1}x$, $x \in [-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}]$. Also, write range of $f(x)$.

Answer (as per CBSE Marking Scheme)	Marks
(a) Given expression $= \frac{3\pi}{4} + \frac{2\pi}{6} + \frac{\pi}{2}$	**1½**
$= \frac{19\pi}{12}$	**½**

OR	
(b)  Correct graph. Here, the points A, B, C and D are respectively $(0, \frac{\pi}{4})$, $(0, -\frac{\pi}{4})$, $(\frac{1}{\sqrt{2}}, 0)$, $(-\frac{1}{\sqrt{2}}, 0)$.	**1**
Range = $[-\frac{\pi}{4}, \frac{\pi}{4}]$	**1**

Q42. **2023** : 65/5/3 **[2 Marks]**

Find the value of $\tan^{-1}[2\cos(2\sin^{-1}(\frac{1}{2}))] + \tan^{-1}1$.

Answer (as per CBSE Marking Scheme)	Marks
$\tan^{-1}[2\cos(2 \cdot \frac{\pi}{6})] + \frac{\pi}{4}$	**1**
$= \tan^{-1}[2 \times \frac{1}{2}] + \frac{\pi}{4} = \frac{\pi}{4} + \frac{\pi}{4} = \frac{\pi}{2}$	**1**

Q43. **2024** : 65/2/1, 65/2/2 **[2 Marks]**

(a) Find the value of $\tan^{-1}(-\frac{1}{\sqrt{3}}) + \cot^{-1}(\frac{1}{\sqrt{3}}) + \tan^{-1}[\sin(-\frac{\pi}{2})]$.

OR

(b) Find the domain of the function $f(x) = \sin^{-1}(x^2 - 4)$. Also, find its range.

Answer (as per CBSE Marking Scheme)	Marks
(a) The given expression $= -\frac{\pi}{6} + \frac{\pi}{3} - \frac{\pi}{4}$	**1½**
$= -\frac{\pi}{12}$	**½**
OR	
(b) $-1 \le x^2 - 4 \le 1 \Rightarrow 3 \le x^2 \le 5$	**½**
Domain = $[-\sqrt{5}, -\sqrt{3}] \cup [\sqrt{3}, \sqrt{5}]$	**½**
Range = $[-\frac{\pi}{2}, \frac{\pi}{2}]$	**1**

Q44. **2024** : 65/2/3 **[2 Marks]**

(a) Find the value of $\sin^{-1}(-\frac{1}{2}) + \cos^{-1}(-\frac{\sqrt{3}}{2}) + \cot^{-1}(\tan\frac{4\pi}{3})$.

OR

(b) Find the domain of $f(x) = \cos^{-1}(1 - x^2)$. Also, find its range.

Answer (as per CBSE Marking Scheme)	Marks
(a) The given expression $= -\frac{\pi}{6} + (\pi - \frac{\pi}{6}) + \frac{\pi}{6}$	**1½**

$= \frac{5\pi}{6}$	½
OR	
(b) $-1 \le 1 - x^2 \le 1 \Rightarrow 0 \le x^2 \le 2$	½
Domain $= [-\sqrt{2}, \sqrt{2}]$	½
Range $= [0, \pi]$	1

Q45. **2024** : 65/5/1 **[2 Marks]**

Find value of k if $\sin^{-1}[k \tan(2 \cos^{-1}(\frac{\sqrt{3}}{2}))] = \frac{\pi}{3}$.

Answer (as per CBSE Marking Scheme)	Marks
$k \tan(2 \cos^{-1}\frac{\sqrt{3}}{2}) = \sin \frac{\pi}{3}$	½
$\Rightarrow k \tan(\frac{\pi}{3}) = \frac{\sqrt{3}}{2}$	½ + ½
$\Rightarrow k\sqrt{3} = \frac{\sqrt{3}}{2} \therefore k = \frac{1}{2}$	½

Q46. **2024** : 65/5/2 **[2 Marks]**

If $a = \sin^{-1}(\frac{\sqrt{2}}{2}) + \cos^{-1}(-\frac{1}{2})$ and $b = \tan^{-1}(\sqrt{3}) - \cot^{-1}(-\frac{1}{\sqrt{3}})$, then find the value of a + b.

Answer (as per CBSE Marking Scheme)	Marks
$a = \frac{\pi}{4} + \frac{2\pi}{3}, b = \frac{\pi}{3} - \frac{2\pi}{3}$	1½
$\therefore a + b = \frac{7\pi}{12}$	½

Q47. **2024 Comptt** : 65/S/2 **[2 Marks]**

Evaluate : $\sin^{-1}(\sin \frac{13\pi}{6}) + \cos^{-1}(\cos \frac{\pi}{3}) + \tan^{-1}(\sqrt{3})$

Answer (as per CBSE Marking Scheme)	Marks
$= \frac{\pi}{6} + \frac{\pi}{3} + \frac{\pi}{3}$	1½
$= \frac{5\pi}{6}$	½

Q48. **2024 Comptt** : 65/S/3 **[2 Marks]**

Find the value of $\tan^{-1}(\tan \frac{3\pi}{5}) + \cos^{-1}(\cos \frac{13\pi}{6}) + \sin^{-1}(-\frac{1}{2})$.

Answer (as per CBSE Marking Scheme)	Marks
$= -\frac{2\pi}{5} + \frac{\pi}{6} - \frac{\pi}{6}$	1½
$= -\frac{2\pi}{5}$	½

Q49. **2025** : 65/1/1 **[2 Marks]**

Evaluate : $\tan^{-1}[2 \sin(2 \cos^{-1}(\frac{\sqrt{3}}{2}))]$

Answer (as per CBSE Marking Scheme)	Marks

$\tan^{-1}[2\sin(2\cos^{-1}\frac{\sqrt{3}}{2})] = \tan^{-1}[2\sin(2\times\frac{\pi}{6})] = \tan^{-1}[2\sin\frac{\pi}{3}]$	**1**
$= \tan^{-1}[2\times\frac{\sqrt{3}}{2}] = \tan^{-1}\sqrt{3} = \frac{\pi}{3}$	**1**

Q50. **2025** : 65/1/2 **[2 Marks]**

Evaluate : $\sin^{-1}(\sin\frac{3\pi}{5})$

Answer (as per CBSE Marking Scheme)	Marks
$\sin^{-1}(\sin\frac{3\pi}{5}) = \sin^{-1}(\sin(\pi-\frac{2\pi}{5}))$	**1**
$= \sin^{-1}(\sin(\frac{2\pi}{5}))$	**½**
$= \frac{2\pi}{5}$	**½**

Q51. **2025 Supp** : 65/S/1, 65/S/2, 65/S/3 **[2 Marks]**

(a) Find the principal value of $\cos^{-1}(-\frac{1}{2}) + 2\sin^{-1}(\frac{1}{2})$.

OR

(b) Prove that : $\tan^{-1}\sqrt{x} = \frac{1}{2}\cos^{-1}(\frac{1-x}{1+x})$, $x \in [0, 1]$

Answer (as per CBSE Marking Scheme)	Marks
(a) $\cos^{-1}(-\frac{1}{2}) + 2\sin^{-1}(\frac{1}{2}) = (\pi-\frac{\pi}{3}) + 2(\frac{\pi}{6})$	**1 + ½**
$= \pi$	**½**
OR	
(b) Put $x = \tan^2\theta \Rightarrow \theta = \tan^{-1}\sqrt{x}$	**½**
RHS $= \frac{1}{2}\cos^{-1}(\frac{1-\tan^2\theta}{1+\tan^2\theta}) = \frac{1}{2}\cos^{-1}(\cos 2\theta) = \frac{1}{2}(2\theta)$	**1**
$= \theta = \tan^{-1}\sqrt{x}$ = LHS	**½**

Q52. **2026** : 65/3/1, 65/3/2, 65/3/3 **[2 Marks]**

Find the value of $\sin[\cot^{-1}\sqrt{2}\ (\cos(\tan^{-1}1))]$.

Answer (as per CBSE Marking Scheme)	Marks
$\sin[\cot^{-1}\sqrt{2}(\cos(\tan^{-1}1))] = \sin[\cot^{-1}\sqrt{2}(\cos\frac{\pi}{4})] = \sin(\cot^{-1}1)$	**1**
$= \sin\frac{\pi}{4} = \frac{1}{\sqrt{2}}$	**1**

Simplification & Proofs

Very Short Answer Questions (2 marks)

Q53. **2023 Supp** : 65/C/1, 65/C/2, 65/C/3 **[2 Marks]**

Simplify : $\tan^{-1}(\frac{\cos x}{1-\sin x})$

Answer (as per CBSE Marking Scheme)	Marks

$\tan^{-1}(\frac{\cos x}{1-\sin x}) = \tan^{-1}(\frac{\sin(\frac{\pi}{2}-x)}{1-\cos(\frac{\pi}{2}-x)})$	½
$= \tan^{-1}(\frac{2\sin(\frac{\pi}{4}-\frac{x}{2})\cos(\frac{\pi}{4}-\frac{x}{2})}{2\sin^2(\frac{\pi}{4}-\frac{x}{2})})$	½
$= \tan^{-1}(\cot(\frac{\pi}{4}-\frac{x}{2})) = \tan^{-1}(\tan(\frac{\pi}{2}-(\frac{\pi}{4}-\frac{x}{2})))$	½
$= \frac{\pi}{4}+\frac{x}{2}$	½

Q54. **2024** : 65/4/1, 65/4/2, 65/4/3 **[2 Marks]**

(a) Express $\tan^{-1}(\frac{\cos x}{1-\sin x})$, where $-\frac{\pi}{2} < x < \frac{\pi}{2}$ in the simplest form.

OR

(b) Find the principal value of $\tan^{-1}(1) + \cos^{-1}(-\frac{1}{2}) + \sin^{-1}(-\frac{1}{\sqrt{2}})$.

Answer (as per CBSE Marking Scheme)	Marks
(a) $y = \tan^{-1}[\frac{\cos x}{1-\sin x}] = \tan^{-1}[\frac{\cos^2\frac{x}{2}-\sin^2\frac{x}{2}}{(\cos\frac{x}{2}-\sin\frac{x}{2})^2}]$	½
$y = \tan^{-1}[\frac{1+\tan\frac{x}{2}}{1-\tan\frac{x}{2}}] = \tan^{-1}[\tan(\frac{\pi}{4}+\frac{x}{2})] = (\frac{\pi}{4}+\frac{x}{2})$	1½
OR	
(b) $\tan^{-1}(1) + [\pi - \cos^{-1}(\frac{1}{2})] - \sin^{-1}(\frac{1}{\sqrt{2}}) = \frac{\pi}{4} + (\pi - \frac{\pi}{3}) - \frac{\pi}{4}$	1½
$= \frac{2\pi}{3}$	½

Q55. **2024** : 65/5/3 **[2 Marks]**

Simplify : $\cos^{-1}x + \cos^{-1}[\frac{x}{2} + \frac{\sqrt{3-3x^2}}{2}]$; $\frac{1}{2} \le x \le 1$

Answer (as per CBSE Marking Scheme)	Marks
Let $x = \cos\theta$,	½
$\cos^{-1}x + \cos^{-1}[\frac{x}{2} + \frac{\sqrt{3-3x^2}}{2}] = \theta + \cos^{-1}[\frac{\cos\theta}{2} + \frac{\sqrt{3}}{2} \times \sin\theta]$	1
$= \theta + \cos^{-1}[\cos(\frac{\pi}{3}-\theta)] = \theta + \frac{\pi}{3} - \theta = \frac{\pi}{3}$	½

Q56. **2026** : 65/1/1, 65/1/2, 65/1/3 **[2 Marks]**

(a) Simplify : $\tan^{-1}(\frac{\cos 2x - \sin 2x}{\cos 2x + \sin 2x})$, $0 < x < \frac{\pi}{4}$.

OR

(b) Evaluate : $\tan(\sin^{-1}1 - \cos^{-1}(-\frac{1}{2}))$

Answer (as per CBSE Marking Scheme)	Marks
(a) Given expression $= \tan^{-1}(\frac{1-\tan 2x}{1+\tan 2x})$	1
$= \tan^{-1}[\tan(\frac{\pi}{4}-2x)] = \frac{\pi}{4} - 2x$	1

OR	
(b) Given expression $= \tan(\frac{\pi}{2} - \frac{2\pi}{3})$	**1**
$= \tan(-\frac{\pi}{6}) = -\frac{1}{\sqrt{3}}$	**1**

Q57. **2026** : 65/1/2 **[2 Marks]**

(a) Simplify : $\cot^{-1}\sqrt{\frac{1+\cos 2x}{1-\cos 2x}}$, $x \in (0, \frac{\pi}{2})$.

OR

(b) Evaluate : $\sin(\tan^{-1}(-\sqrt{3}) - \sec^{-1}2)$

Answer (as per CBSE Marking Scheme)	Marks
(a) Given expression $= \cot^{-1}(\sqrt{\frac{2\cos^2 x}{2\sin^2 x}})$	**1**
$= \cot^{-1}(\cot x) = x$	**1**
OR	
(b) Given expression $= \sin(-\frac{\pi}{3} - \frac{\pi}{3})$	**1**
$= \sin(-\frac{2\pi}{3}) = -\frac{\sqrt{3}}{2}$	**1**

Q58. **2026** : 65/1/3 **[2 Marks]**

(a) Simplify : $\sin^{-1}\sqrt{\frac{1+\cos 2x}{2}}$, $0 < x < \frac{\pi}{2}$.

OR

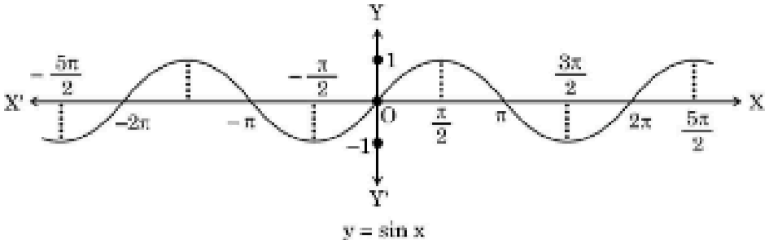
(b) Evaluate : $\cos[\sin^{-1}(-1) - \tan^{-1}(-\sqrt{3})]$.

Answer (as per CBSE Marking Scheme)	Marks
(a) Given expression $= \sin^{-1}(\sqrt{\frac{2\cos^2 x}{2}}) = \sin^{-1}(\cos x)$	**1**
$= \sin^{-1}(\sin(\frac{\pi}{2} - x)) = \frac{\pi}{2} - x$	**1**
OR	
(b) Given expression $= \cos(-\frac{\pi}{2} + \frac{\pi}{3})$	**1**
$= \cos(-\frac{\pi}{6}) = \frac{\sqrt{3}}{2}$	**1**

Case Study Based Questions

Q59. **2024** : 65/1/1, 65/1/2, 65/1/3 **[4 Marks]**

Case Study: If a function $f : X \to Y$ defined as $f(x) = y$ is one-one and onto, then we can define a unique function $g : Y \to X$ such that $g(y) = x$, where $x \in X$ and $y = f(x)$, $y \in Y$. Function g is called the inverse of function f. The domain of sine function is $\mathbb{R}$ and function sine : $\mathbb{R} \to \mathbb{R}$ is neither one-one nor onto. The following graph shows the sine function.



y = sin x

Let sine function be defined from set A to $[-1, 1]$ such that inverse of sine function exists, i.e., $\sin^{-1}x$ is defined from $[-1, 1]$ to A.

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

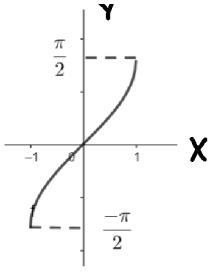
(i) If A is the interval other than principal value branch, give an example of one such interval. *1*

(ii) If $\sin^{-1}(x)$ is defined from $[-1, 1]$ to its principal value branch, find the value of $\sin^{-1}(-\frac{1}{2}) - \sin^{-1}(1)$. *1*

(iii) (a) Draw the graph of $\sin^{-1}x$ from $[-1, 1]$ to its principal value branch. *2*

OR

(b) Find the domain and range of $f(x) = 2\sin^{-1}(1 - x)$.

Answer (as per CBSE Marking Scheme)	Marks
(i) $[\frac{\pi}{2}, \frac{3\pi}{2}]$ or any other interval corresponding to the domain $[-1, 1]$	**1**
(ii) $\sin^{-1}(-\frac{1}{2}) - \sin^{-1}(1) = -\frac{\pi}{6} - \frac{\pi}{2} = -\frac{4\pi}{6}$ or $-\frac{2\pi}{3}$	**1**
(iii)(a)  Correct graph	**2**
OR	
(iii)(b) $f(x) = 2\sin^{-1}(1 - x)$; $-1 \le 1 - x \le 1 \Rightarrow -2 \le -x \le 0 \Rightarrow 0 \le x \le 2$	½
Domain = $[0, 2]$	½
$-\frac{\pi}{2} \le \sin^{-1}(1 - x) \le \frac{\pi}{2} \Rightarrow -\pi \le 2\sin^{-1}(1 - x) \le \pi$	½
So range = $[-\pi, \pi]$	½

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