GRADE XII
Question Bank (MATHEMATICS)
Chapter-2 Inverse Trigonometric Functions

1 Marks:

1. Domain of $\sin^{-1}(2x-3)$ is **[BOARD 2025]**

   a) $(-1,0) \cup (1,\sqrt{2})$　　　　　　c) $[-\sqrt{2},-1] \cup [1,\sqrt{2}]$

   b) $(-\sqrt{2},-1) \cup (0,1)$　　　　　　d) $(-\sqrt{2},-1) \cup (1,\sqrt{2})$

2. Domain of $\cos^{-1}x + \sin x$ is **[BOARD 2025]**

   a) R 　　　　b) $(-1,1)$ 　　　　c) $[-1,1]$ 　　　　d) φ

3. If $y = \sin^{-1}x, -1 \le x \le 0$, then the range of y is **[BOARD 2025]**

   a) $\left(-\frac{\pi}{2},0\right)$ 　　b) $\left[-\frac{\pi}{2},0\right]$ 　　c) $\left[-\frac{\pi}{2},0\right)$ 　　d) $\left(-\frac{\pi}{2},0\right]$

4. $sin\left[\frac{\pi}{3} + \sin^{-1}\frac{1}{2}\right]$ is equal to **[BOARD 2023]**

   a) 1 　　b) $\frac{1}{2}$ 　　c) $\frac{1}{3}$ 　　d) $\frac{1}{4}$

5. $\left[\sec^{-1}(-\sqrt{2}) - \tan^{-1}\left(-\frac{1}{\sqrt{3}}\right)\right]$ is equal to **[BOARD 2025]**

   a) $\frac{11\pi}{12}$ 　　b) $\frac{5\pi}{12}$ 　　c) $-\frac{5\pi}{12}$ 　　d) $\frac{7\pi}{12}$

6. The principal value branch of $\cos^{-1}x$ is **[BOARD 2025]**

   a) $\left[\frac{\pi}{2},\frac{3\pi}{2}\right]$ 　　b) $[\pi,2\pi]$ 　　c) $[0,\pi]$ 　　d) $[2\pi,3\pi]$

7. The principal value of $\sin^{-1}\left(\cos\frac{43\pi}{5}\right)$ is **[BOARD 2025]**

   a) $\frac{-7\pi}{5}$ 　　b) $\frac{-\pi}{10}$ 　　c) $\frac{\pi}{10}$ 　　d) $\frac{3\pi}{5}$

8. The principal value of $\sin^{-1}\left(\sin\left(-\frac{10\pi}{3}\right)\right)$ is **[BOARD 2025]**

   a) $-\frac{2\pi}{3}$ 　　b) $-\frac{\pi}{3}$ 　　c) $\frac{\pi}{3}$ 　　d) $\frac{2\pi}{3}$

9. The principal value of $\cot^{-1}\left(-\frac{1}{\sqrt{3}}\right)$ is **[BOARD 2025]**

   a) $-\frac{\pi}{3}$ 　　b) $-\frac{2\pi}{3}$ 　　c) $\frac{\pi}{3}$ 　　d) $\frac{2\pi}{3}$

10. The value of $\cos\left(\frac{\pi}{6} + \cot^{-1}(-\sqrt{3})\right)$ is **[BOARD 2025]**

    a) -1 　　b) $-\frac{\sqrt{3}}{2}$ 　　c) 0 　　d) 1

Options for Assertion and Reasoning Questions:

a) Both assertion(A) and reason(R) are true and reason(R) is the correct explanation of assertion(A)

b) Both assertion(A) and reason(R) are true but reason(R) is not the correct explanation of assertion(A)

c) Assertion (A) is true but reason (R) is false

d) Assertion (A) is false but reason (R) is true

11. **Assertion (A):** Set of values of $\sec^{-1}\left(\frac{\sqrt{3}}{2}\right)$ is a null set. **[BOARD 2025]**

   Reason (R): $\sec^{-1} x$ is defined for $x \in R - (-1, 1)$.

12. **Assertion (A):** The principal value of $\cot^{-1} \sqrt{3}$ is $\frac{\pi}{6}$. **[BOARD 2023]**

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

13. **Assertion (A):** The range of the function $f(x) = 2 \sin^{-1} x + \frac{3\pi}{2}$ where $x \in [-1, 1]$, is $\left[\frac{\pi}{2}, \frac{5\pi}{2}\right]$. **[BOARD 2023]**

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

14. **Assertion (A):** Range of $\sin^{-1} x + 2 \cos^{-1} x$ is $[0, \pi]$. **[BOARD 2023]**

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

15. **Assertion (A):** Maximum value of $(\cos^{-1} x)^2$ is π^2. **[BOARD 2023]**

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

16. **Assertion (A):** All trigonometric functions have their inverses over their respective domains. **[BOARD 2023]**

   Reason (R): The inverse of $\tan^{-1} x$ exists for some $x \in R$.

17. **Assertion (A):** Domain of $y = \cos^{-1} x$ is $[-1, 1]$. **[BOARD 2024]**

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

18. **Assertion (A):** $\cos^{-1}\left(\cos \frac{13\pi}{6}\right)$ is equal to $\frac{\pi}{6}$. **[BOARD 2024]**

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

2 Marks:

1. Find the domain of $\sin^{-1}(-x^2)$. **[BOARD 2025]**

2. Find the domain of $\sin^{-1} \sqrt{x-1}$. **[BOARD 2025]**

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3. Find the domain of $\sin^{-1}(x^2 - 3)$. **[BOARD 2025]**

4. Find the domain of the function $\cos^{-1}(x^2 - 4)$. **[BOARD 2025]**

5. Find the domain of the function $\sec^{-1}(2x + 1)$. **[BOARD 2025]**

6. Find the domain of $\sin^{-1}(x^2 - 4)$ and find its range. **[BOARD 2023 & 2024]**

7. Find the domain of $\cos^{-1}(1 - x^2)$. Also, find its range. **[BOARD 2024]**

8. Write the domain and range (principal value branch) of $\tan^{-1} x$. **[BOARD 2023]**

9. Simplify $\tan^{-1}\left(\frac{\cos x}{1 - \sin x}\right)$. **[BOARD 2023 & 2024]**

10. Simplify $\sin^{-1}\left(\frac{x}{\sqrt{1 + x^2}}\right)$. **[BOARD 2025]**

11. Simplify $\cos^{-1} x + \cos^{-1}\left[\frac{x}{2} + \frac{\sqrt{3 - 3x^2}}{2}\right]$; $\frac{1}{2} \leq x \leq 1$. **[BOARD 2024]**

12. Find the principal value of $\tan^{-1} 1 + \cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1}\left(-\frac{1}{\sqrt{2}}\right)$. **[BOARD 2024]**

13. Evaluate: $\tan^{-1}\left[2 \sin\left(2 \cos^{-1}\frac{\sqrt{3}}{2}\right)\right]$. **[BOARD 2025]**

14. Evaluate: $\sin^{-1}\left(\sin\frac{3\pi}{5}\right)$. **[BOARD 2025]**

15. Evaluate: $\cos^{-1}\left(\cos\left(-\frac{7\pi}{3}\right)\right)$. **[BOARD 2023]**

16. Evaluate: $\sin^{-1}\left(\sin\frac{3\pi}{4}\right) + \cos^{-1}\left(\cos\frac{3\pi}{4}\right) + \tan^{-1} 1$. **[BOARD 2023]**

17. Evaluate: $\sin^{-1}\left(\sin\frac{3\pi}{4}\right) + \cos^{-1}(\cos \pi) + \tan^{-1} 1$. **[BOARD 2023]**

18. Evaluate: $\sin^{-1}\left(\sin\frac{13\pi}{6}\right) + \cos^{-1}\left(\cos\frac{\pi}{3}\right) + \tan^{-1} \sqrt{3}$. **[BOARD 2024]**

19. Evaluate: $3 \sin^{-1}\left(\frac{1}{\sqrt{2}}\right) + 2 \cos^{-1}\left(\frac{\sqrt{3}}{2}\right) + \cos^{-1} 0$. **[BOARD 2023]**

20. Evaluate: $\sec^2\left(\tan^{-1}\frac{1}{2}\right) + cosec^2\left(\cot^{-1}\frac{1}{3}\right)$. **[BOARD 2024]**

21. Evaluate: $\cot^2\{cosec^{-1}3\} + \sin^2\left\{\cos^{-1}\frac{1}{3}\right\}$. **[BOARD 2024]**

22. Find the value of $\sin^2\left\{\cos^{-1}\frac{3}{5}\right\} + \tan^2\{\sec^{-1} 3\}$. **[BOARD 2024]**

23. Find the value of $\tan^{-1}\left[2 \cos\left(2 \sin^{-1}\frac{1}{2}\right)\right] + \tan^{-1} 1$. **[BOARD 2023]**

24. Find the value of $\tan^{-1}\left(-\frac{1}{\sqrt{3}}\right) + \cot^{-1}\left(\frac{1}{\sqrt{3}}\right) + \tan^{-1}\left[\sin\left(-\frac{\pi}{2}\right)\right]$. **[BOARD 2024]**

25. Find the value of $\sin^{-1}\left(-\frac{1}{2}\right) + \cos^{-1}\left(-\frac{\sqrt{3}}{2}\right) + \cot^{-1}\left(\tan\frac{4\pi}{3}\right)$. **[BOARD 2024]**

26. Find the value of $\cos^{-1}\left(\frac{1}{2}\right) - \tan^{-1}\left(-\frac{1}{\sqrt{3}}\right) + cosec^{-1}(-2)$. **[BOARD 2024]**

27. Find the value of $\tan^{-1}\left(\tan\frac{3\pi}{5}\right) + \cos^{-1}\left(\cos\frac{13\pi}{6}\right) + \sin^{-1}\left(-\frac{1}{2}\right)$. **[BOARD 2024]**

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28. Find the value of k if $\sin^{-1}\left[k\tan\left(2\cos^{-1}\frac{\sqrt{3}}{2}\right)\right] = \frac{\pi}{3}$. **[BOARD 2024]**

29. Solve for x: $2\tan^{-1}x + \sin^{-1}\left(\frac{2x}{1+x^2}\right) = 4\sqrt{3}$. **[BOARD 2025]**

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

   $a + b$. **[BOARD 2024]**

31. Draw the graph of principal value branch of $\cos^{-1}x$. **[BOARD 2023]**

32. Draw the graph of $\cos^{-1}x$ where $x \in [-1, 0]$. Also, write its range. **[BOARD 2023]**

33. Draw the graph of $\sin^{-1}x, x \in \left[\frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right]$. Also, write its range. **[BOARD 2023]**

Case Based Questions:

1. 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 $y \in Y$. Function g is called the inverse of function f.

   The domain of sine function is R and function $\sin: R \to R$ is neither one-one nor onto. The following graph shows the sine function.

   y = sin x
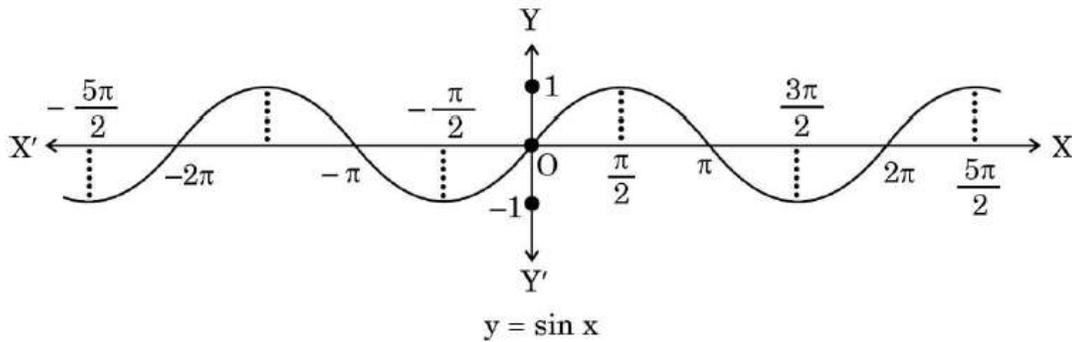
   Let sine function be defined from the set A to [-1, 1] such that inverse of sine function exists, i.e, $\sin^{-1}x$ is defined from [-1, 1] to A. **[BOARD 2024]**

   On the above information, answer for 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 $\sin^{-1}\left(\frac{-1}{2}\right) - \sin^{-1}1$. **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 $2\sin^{-1}(1-x)$. **2**

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