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Inverse Trigonometric Functions — CBSE Class 12 Mathematics Chapter Test

FREE CHAPTER TEST · CLASS XII · MATHEMATICS (041) · PATTERN OF THE CBSE SAMPLE QUESTION PAPER 2026-27

TIME ALLOWED	MAXIMUM MARKS	QUESTIONS	NAME / ROLL NO.
1½ hours	40	19 (A 10 · B 3 · C 2 · D 2 · E 2)	

GENERAL INSTRUCTIONS

Read the following instructions very carefully and strictly follow them:

1. This question paper contains 19 questions. All questions are compulsory.
2. This question paper is divided into five sections: A, B, C, D and E.
3. In Section A, Questions 1 to 8 are multiple choice questions (MCQs) and Questions 9 and 10 are assertion-reason based questions of 1 mark each.
4. In Section B, Q11–13 are very short answer (VSA) type questions, carrying 2 marks each.
5. In Section C, Q14–15 are short answer (SA) type questions, carrying 3 marks each.
6. In Section D, Q16–17 are long answer (LA) type questions, carrying 5 marks each.
7. In Section E, Q18–19 are case study based questions, carrying 4 marks each, with sub-parts of the values of 1, 1 and 2 marks.
8. There is no overall choice. However, an internal choice has been provided in 1 question of Section B, 1 question of Section C, 1 question of Section D and in the 2-mark sub-part of each question of Section E.
9. Use of calculators is not allowed. log x denotes the natural logarithm of x.
10. This chapter test follows the section structure, question types and marks per question of the CBSE Class XII Mathematics (041) Sample Question Paper 2026-27, released on 21 September 2026 at cbseacademic.nic.in, at half the length of the 80-mark board paper: 40 marks in 1½ hours.
11. The answer key and the marking scheme are at the end of this booklet. Attempt the paper in 1½ hours before you look at them.

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Chapter: Inverse Trigonometric Functions · **Topics:** Principal value branches · Domain and range of inverse trigonometric functions · Graphs of inverse trigonometric functions · Evaluating expressions with principal values

SECTION A

This section comprises 10 questions of 1 mark each: 8 multiple choice questions (MCQs) and 2 assertion-reason based questions.

1. The principal value of $\sin^{-1}(-\frac{\sqrt{3}}{2})$ is 1

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

(C) $\frac{4\pi}{3}$ (D) $-\frac{\pi}{6}$

2. The principal value of $\cos^{-1}(-\frac{\sqrt{3}}{2})$ is 1

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

(C) $\frac{\pi}{6}$ (D) $\frac{7\pi}{6}$

3. The value of $\tan^{-1}(1) - \sec^{-1}(-\sqrt{2})$ is 1

(A) π (B) $\frac{\pi}{2}$

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

4. The domain of the function $f(x) = \cos^{-1}(3x - 1)$ is 1

(A) $[-1, 1]$ (B) $[-1, 0]$

(C) $[0, \frac{2}{3}]$ (D) $[\frac{1}{3}, 1]$

5. The value of $\sin^{-1}(\sin\frac{4\pi}{5})$ is 1

(A) $\frac{4\pi}{5}$ (B) $-\frac{\pi}{5}$

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

6. The range of the principal value branch of $\cot^{-1} x$ is 1

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

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

7. The value of $\cos^{-1}(\cos\frac{5\pi}{4})$ is 1

(A) $\frac{3\pi}{4}$ (B) $\frac{5\pi}{4}$

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

8. The value of $\sin(\frac{\pi}{6} - \sin^{-1}(-\frac{\sqrt{3}}{2}))$ is 1

(A) $\frac{1}{2}$ (B) 1

(C) 0 (D) $\frac{\sqrt{3}}{2}$

9. **Assertion (A):** The principal value of $\cos^{-1}(\cos\frac{3\pi}{2})$ is $\frac{\pi}{2}$. 1

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

(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.

10. **Assertion (A):** $\sin^{-1}(\sin\frac{7\pi}{8}) = \frac{7\pi}{8}$. 1

Reason (R): $\sin^{-1}(\sin x) = x$ for every x in $[-\frac{\pi}{2}, \frac{\pi}{2}]$.

(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.

SECTION B

This section comprises 3 very short answer (VSA) type questions of 2 marks each.

11. Find the value of $\tan^{-1}(-\sqrt{3}) + \cos^{-1}(-\frac{1}{\sqrt{2}})$. 2

12. (a) Find the domain of the function $f(x) = \sin^{-1}(x^2 - 3)$. 2

OR

(b) Find the domain of the function $f(x) = \cos^{-1}(2x + 3)$.

13. Find the value of $\cos^{-1}(\sin\frac{\pi}{7})$. 2

SECTION C

This section comprises 2 short answer (SA) type questions of 3 marks each.

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

OR

(b) Find the value of $\cot^{-1}(-1) + \operatorname{cosec}^{-1}(\sqrt{2}) + \sec^{-1}(-2)$.

15. Find the value of $\sin^{-1}(\sin\frac{3\pi}{4}) + \cos^{-1}(\cos\frac{4\pi}{3}) + \tan^{-1}(\tan\frac{5\pi}{6})$. 3

SECTION D

This section comprises 2 long answer (LA) type questions of 5 marks each.

16. (a) (i) Write the domain and the range (principal value branch) of $\sin^{-1} x$, $\cos^{-1} x$ and $\tan^{-1} x$, and describe the graph of $y = \sin^{-1} x$. 5

(ii) Find the value of $\sin^{-1}(\sin 4)$, where 4 is in radians.

OR

(b) Find the values of (i) $\tan^{-1}(\tan\frac{5\pi}{4})$, (ii) $\cos^{-1}(\cos\frac{11\pi}{6})$, (iii) $\sin^{-1}(\sin 3)$, (iv) $\sec^{-1}(\sec\frac{7\pi}{4})$, (v) $\cot^{-1}(\cot(-\frac{\pi}{3}))$.

17. Let $\theta = \cos^{-1}(-\frac{3}{5})$. Find the values of (i) $\sin\theta$, (ii) $\tan\theta$, (iii) $\sin 2\theta$ and (iv) $\cos 2\theta$. 5

SECTION E

This section comprises 2 case study based questions of 4 marks each, with sub-parts of 1, 1 and 2 marks.

18. A ladder 10 m long leans against a vertical wall. Its foot is 6 m from the wall on level ground, and it reaches 8 m up the wall. Let θ be the angle the ladder makes with the ground.

(i) Express θ using the inverse cosine function. [1]

(ii) Express θ using the inverse tangent function. [1]

(iii) Let $\varphi = \sin^{-1}(\frac{3}{5})$. Find $\sin(\theta + \varphi)$, and hence the value of $\theta + \varphi$. [2]

OR

(iii) Find the value of $\cos 2\theta$. [2]

19. From a point on level ground $30\sqrt{3}$ m from the foot of a tower, a drone is seen hovering above the tower. When it is 30 m above the ground, the angle of elevation is θ_1; when it has risen to $30\sqrt{3}$ m, the angle of elevation is θ_2.

(i) Express θ_1 as an inverse tangent, and find its value. [1]

(ii) Find θ_2. [1]

(iii) Find the principal value of $\sin^{-1}(\sin(\theta_1 + \theta_2))$. [2]

OR

(iii) Find the principal value of $\cos^{-1}(\cos(\theta_1 + 2\theta_2))$. [2]

END OF THE QUESTION PAPER

ANSWER KEY — SECTION A

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
(B)	(A)	(D)	(C)	(C)	(D)	(A)	(B)	(A)	(D)

MARKING SCHEME AND WORKED SOLUTIONS

Marks for each step are shown in brackets, as in the CBSE marking scheme. Any correct alternative method earns full marks.

Q1. Answer (B). $\sin(-\pi/3) = -\sqrt{3}/2$ and $-\pi/3$ lies in $[-\pi/2, \pi/2]$.

Q2. Answer (A). $\cos(5\pi/6) = -\sqrt{3}/2$ and $5\pi/6$ lies in $[0, \pi]$.

Q3. Answer (D). $\pi/4 - 3\pi/4 = -\pi/2$ ($\sec^{-1}(-\sqrt{2}) = 3\pi/4$, in $[0, \pi] - \{\pi/2\}$).

Q4. Answer (C). $-1 \le 3x - 1 \le 1$ gives $0 \le 3x \le 2$, i.e. $0 \le x \le 2/3$.

Q5. Answer (C). $\sin(4\pi/5) = \sin(\pi/5)$, and $\pi/5$ is the angle in $[-\pi/2, \pi/2]$.

Q6. Answer (D). $\cot^{-1} : \mathbb{R} \to (0, \pi)$.

Q7. Answer (A). $\cos(5\pi/4) = \cos(3\pi/4)$, and $3\pi/4$ lies in $[0, \pi]$.

Q8. Answer (B). $\sin^{-1}(-\sqrt{3}/2) = -\pi/3$, so the angle is $\pi/6 + \pi/3 = \pi/2$, and $\sin(\pi/2) = 1$.

Q9. Answer (A). $\cos(3\pi/2) = 0$ and the angle in $[0, \pi]$ whose cosine is 0 is $\pi/2$. R explains why the answer is $\pi/2$ and not $3\pi/2$. Answer (A).

Q10. Answer (D). $7\pi/8$ is not in $[-\pi/2, \pi/2]$; $\sin^{-1}(\sin 7\pi/8) = \pi/8$. A is false, R is true. Answer (D).

Q11. (2 marks) Answer: $5\pi/12$.
$\tan^{-1}(-\sqrt{3}) = -\pi/3$ (in $(-\pi/2, \pi/2)$); $\cos^{-1}(-1/\sqrt{2}) = 3\pi/4$ (in $[0, \pi]$). [1]
Sum $= -\pi/3 + 3\pi/4 = (-4\pi + 9\pi)/12 = 5\pi/12$. [1]

Q12. (2 marks) Answer: (a) $[-2, -\sqrt{2}] \cup [\sqrt{2}, 2]$; (b) $[-2, -1]$.
(a) We need $-1 \le x^2 - 3 \le 1$, i.e. $2 \le x^2 \le 4$. [1] So $\sqrt{2} \le |x| \le 2$: the domain is $[-2, -\sqrt{2}] \cup [\sqrt{2}, 2]$. [1]
OR (b) $-1 \le 2x + 3 \le 1$ gives $-4 \le 2x \le -2$. [1] The domain is $[-2, -1]$. [1]

Q13. (2 marks) Answer: $5\pi/14$.
$\sin(\pi/7) = \cos(\pi/2 - \pi/7) = \cos(5\pi/14)$. [1]
$5\pi/14$ lies in $[0, \pi]$, so $\cos^{-1}(\sin \pi/7) = 5\pi/14$. [1]

Q14. (3 marks) Answer: (a) $-\pi/6$; (b) $5\pi/3$.
(a) $\tan^{-1}(-1) = -\pi/4$. [1] $\cos^{-1}(1/2) = \pi/3$ and $\sin^{-1}(-1/\sqrt{2}) = -\pi/4$. [1] Sum $= -\pi/4 + \pi/3 - \pi/4 = (-3\pi + 4\pi - 3\pi)/12 = -\pi/6$. [1]
OR (b) $\cot^{-1}(-1) = 3\pi/4$ (in $(0, \pi)$). [1] $\operatorname{cosec}^{-1}(\sqrt{2}) = \pi/4$ (in $[-\pi/2, \pi/2] - \{0\}$), and $\sec^{-1}(-2) = 2\pi/3$ (in $[0, \pi] - \{\pi/2\}$). [1]
Sum $= 3\pi/4 + \pi/4 + 2\pi/3 = 5\pi/3$. [1]

Q15. (3 marks) Answer: $3\pi/4$.
$\sin(3\pi/4) = \sin(\pi/4)$, so $\sin^{-1}(\sin 3\pi/4) = \pi/4$. [1]
$\cos(4\pi/3) = \cos(2\pi/3)$, so $\cos^{-1}(\cos 4\pi/3) = 2\pi/3$; $\tan(5\pi/6) = \tan(-\pi/6)$, so $\tan^{-1}(\tan 5\pi/6) = -\pi/6$. [1]
Sum $= \pi/4 + 2\pi/3 - \pi/6 = (3\pi + 8\pi - 2\pi)/12 = 3\pi/4$. [1]

Q16. (5 marks) Answer: (a) $\pi - 4$; (b) $\pi/4$, $\pi/6$, $\pi - 3$, $\pi/4$, $2\pi/3$.

(a) (i) $\sin^{-1}$: domain $[-1, 1]$, range $[-\pi/2, \pi/2]$; $\cos^{-1}$: domain $[-1, 1]$, range $[0, \pi]$; $\tan^{-1}$: domain $\mathbb{R}$, range $(-\pi/2, \pi/2)$. [1½] The graph of $y = \sin^{-1} x$ is the reflection of the graph of $y = \sin x$, $-\pi/2 \le x \le \pi/2$, in the line $y = x$: it rises from $(-1, -\pi/2)$ through $(0, 0)$ to $(1, \pi/2)$. [1½]

(ii) $\pi - 4 \approx -0.86$ lies in $[-\pi/2, \pi/2]$, and $\sin(\pi - 4) = \sin 4$. [1] So $\sin^{-1}(\sin 4) = \pi - 4$. [1]

OR (b) (i) $\tan(5\pi/4) = \tan(\pi/4)$: $\pi/4$. [1] (ii) $\cos(11\pi/6) = \cos(\pi/6)$: $\pi/6$. [1] (iii) $\sin 3 = \sin(\pi - 3)$ and $\pi - 3 \approx 0.14$ lies in $[-\pi/2, \pi/2]$: $\pi - 3$. [1] (iv) $\sec(7\pi/4) = \sqrt{2}$ and $\sec^{-1}(\sqrt{2}) = \pi/4$. [1] (v) $\cot(-\pi/3) = -1/\sqrt{3}$ and $\cot^{-1}(-1/\sqrt{3}) = 2\pi/3$. [1]

Q17. (5 marks) Answer: $4/5$; $-4/3$; $-24/25$; $-7/25$.

θ lies in $[0, \pi]$ and $\cos\theta = -3/5 < 0$, so θ is in the second quadrant $(\pi/2, \pi)$. [1]

(i) $\sin\theta = +\sqrt{(1 - 9/25)} = 4/5$ ($\sin\theta \ge 0$ in $[0, \pi]$). [1]

(ii) $\tan\theta = (4/5)/(-3/5) = -4/3$. [1]

(iii) $\sin 2\theta = 2\sin\theta\cos\theta = 2(4/5)(-3/5) = -24/25$. [1]

(iv) $\cos 2\theta = 2\cos^2\theta - 1 = 18/25 - 1 = -7/25$. [1]

Q18. (4 marks) Answer: (i) $\cos^{-1}(3/5)$; (ii) $\tan^{-1}(4/3)$; (iii) 1, $\pi/2$; or $-7/25$.

(i) $\cos\theta = 6/10$, so $\theta = \cos^{-1}(3/5)$. [1]

(ii) $\tan\theta = 8/6$, so $\theta = \tan^{-1}(4/3)$. [1]

(iii)(a) $\sin\theta = 4/5$, $\cos\theta = 3/5$; $\sin\varphi = 3/5$, $\cos\varphi = 4/5$ (φ in $[0, \pi/2]$). $\sin(\theta + \varphi) = (4/5)(4/5) + (3/5)(3/5) = 1$. [1] θ and φ are both acute, so $\theta + \varphi = \pi/2$. [1]

OR (iii)(b) $\cos 2\theta = 2\cos^2\theta - 1 = 2(9/25) - 1 = -7/25$. [2]

Q19. (4 marks) Answer: (i) $\pi/6$; (ii) $\pi/4$; (iii) $5\pi/12$, or $2\pi/3$.

(i) $\theta_1 = \tan^{-1}(30/(30\sqrt{3})) = \tan^{-1}(1/\sqrt{3}) = \pi/6$. [1]

(ii) $\theta_2 = \tan^{-1}(30\sqrt{3}/(30\sqrt{3})) = \tan^{-1} 1 = \pi/4$. [1]

(iii)(a) $\theta_1 + \theta_2 = 5\pi/12$. [1] It lies in $[-\pi/2, \pi/2]$, so $\sin^{-1}(\sin 5\pi/12) = 5\pi/12$. [1]

OR (iii)(b) $\theta_1 + 2\theta_2 = \pi/6 + \pi/2 = 2\pi/3$. [1] It lies in $[0, \pi]$, so $\cos^{-1}(\cos 2\pi/3) = 2\pi/3$. [1]

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