NCERT Solutions Class 12 Maths
Chapter 2: Inverse Trigonometric Functions
EXERCISE 2.1

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Quick Summary: In NCERT Solutions Class 12 Maths Chapter 2 Exercise 2.1, students learn the fundamental concepts of inverse trigonometric functions and their principal values. This exercise covers essential properties and domain-range relationships of inverse trig functions like $\sin^{-1}x$, $\cos^{-1}x$, and $\tan^{-1}x$, which are crucial for solving complex problems in CBSE board exams and competitive tests.

Key Takeaways:

- Principal value ranges: $\sin^{-1}x \in [-\frac{\pi}{2}, \frac{\pi}{2}]$, $\cos^{-1}x \in [0, \pi]$, $\tan^{-1}x \in (-\frac{\pi}{2}, \frac{\pi}{2})$
- Domain restrictions for inverse functions: $\sin^{-1}x$ and $\cos^{-1}x$ have domain [-1, 1]
- Finding principal values of $\text{cosec}^{-1}x$, $\sec^{-1}x$, and $\cot^{-1}x$ using reciprocal relationships
- Essential for solving integration, differentiation, and equation problems in higher mathematics

Complete Solutions

Question 1

QUESTION

Find the principal value of \sin^-1\left(-(1)/(2)\right).

SOLUTION

We need to find the principal value of . This means we need to find an angle within the range of the principal values of the inverse sine function that gives us when we take its sine.

Step 1: Recall the range of the principal value branch of

The principal value branch of is . This means we are looking for an angle between and whose sine is .

Step 2: Determine the angle whose sine is

We know that . Since we want the sine to be negative, we need to consider angles in the third or fourth quadrants. However, our principal value branch only includes angles between and , which corresponds to the first and fourth quadrants.

Therefore, we consider the angle , which lies in the fourth quadrant and within the principal value range.

Step 3: Verify the sine of the angle

We know that . Therefore, .

Step 4: State the principal value

Since and is within the range , the principal value of is .

Final Answer:

ANSWER

-(π)/(6)

Question 2

QUESTION

Find the principal value of \cos^-1\left(√32\right).

SOLUTION

We need to find the principal value of . This means we need to find an angle whose cosine is and lies within the principal branch of the inverse cosine function.

Step 1: Recall the range of the principal value of

The principal value of lies in the interval . This means the angle we are looking for must be between 0 and (inclusive).

Step 2: Find the angle whose cosine is

We know from the standard trigonometric values that . In degrees, is 30 degrees.

Step 3: Check if the angle lies within the principal value range

Since lies in the interval , it is the principal value of .

Step 4: Write the final answer

Therefore, the principal value of is .

Final Answer:

ANSWER

(π)/(6)

Question 3

QUESTION

Find the principal value of \textcosec^-1(2).

SOLUTION

We need to find the principal value of . This involves understanding the range of the inverse cosecant function and finding an angle within that range whose cosecant is 2.

Step 1: Define the inverse cosecant function

The inverse cosecant function, denoted as , gives the angle whose cosecant is . The principal value range for is .

Step 2: Set up the equation

Let . This means .

Step 3: Relate cosecant to sine

Since , we have .

Step 4: Find the angle whose sine is 1/2

We know that . Therefore, .

Step 5: Check if the angle is within the principal value range

The angle lies within the principal value range of , which is . Since , it is a valid principal value.

Final Answer: The principal value of is .

ANSWER

(π)/(6)

Question 4

QUESTION

Find the principal value of \tan^-1(-√3).

SOLUTION

We are asked to find the principal value of the inverse tangent function . This means we need to find an angle within the principal branch of the inverse tangent function whose tangent is .

Step 1: Recall the range of the principal value of

The principal value of lies in the interval , which means the angle must be between and (exclusive).

Step 2: Find the angle whose tangent is

We know that . Since we want the tangent to be , we need to consider the quadrants where the tangent function is negative. Tangent is negative in the second and fourth quadrants.

Step 3: Determine the correct angle within the principal value range

Since the principal value range is , we need to find an angle in this interval whose tangent is . The angle satisfies this condition because:

Also, lies within the interval .

Step 4: Write the final answer

Therefore, the principal value of is .

ANSWER

-(π)/(3)

Question 5

QUESTION

Find the principal value of \cos^-1\left(-(1)/(2)\right).

SOLUTION

We need to find the principal value of . This means we need to find an angle within the range of the principal values of the inverse cosine function that satisfies the given condition.

Step 1: Recall the range of principal values for

The principal value range for is . This means the angle we are looking for must be between 0 and (inclusive).

Step 2: Determine the angle whose cosine is

We are looking for an angle such that .

Step 3: Consider the unit circle and cosine values

Cosine is negative in the second and third quadrants. Since the range of principal values is , we only consider the second quadrant.

Step 4: Find the reference angle

The reference angle is the acute angle whose cosine is . We know that . So, the reference angle is .

Step 5: Calculate the angle in the second quadrant

To find the angle in the second quadrant with a reference angle of , we subtract the reference angle from :

Step 6: Verify the solution

We check that and that is within the range . Since both conditions are met, is the principal value.

Final Answer: The principal value of is .

ANSWER

(2π)/(3)

Question 6

QUESTION

Find the principal value of \tan^-1(-1).

SOLUTION

The question asks us to find the principal value of the inverse tangent function, . This means we need to find an angle within the principal branch of the inverse tangent function that gives us a tangent value of -1.

Step 1: Recall the range of the principal value branch of

The principal value branch of is . This means the angle we are looking for must lie between and (exclusive of the endpoints).

Step 2: Determine the angle whose tangent is -1

We need to find an angle such that and . We know that . Since the tangent function is negative in the second and fourth quadrants, we need to consider the fourth quadrant angle that has a reference angle of .

Step 3: Find the angle in the correct range

The angle lies in the fourth quadrant and within the principal value branch . We can verify that .

Step 4: State the principal value

Therefore, the principal value of is .

Final Answer:

ANSWER

-(π)/(4)

Question 7

QUESTION

Find the principal value of \sec^-1\left((2)/(√3)\right).

SOLUTION

We need to find the principal value of . This involves understanding the range of the inverse secant function and finding an angle within that range whose secant is .

Step 1: Define the inverse secant function

The inverse secant function, denoted as , gives the angle whose secant is . The principal value branch of is . This means the principal value must lie between 0 and (inclusive), excluding .

Step 2: Relate secant to cosine

Recall that . Therefore, . This allows us to use our knowledge of the inverse cosine function.

Step 3: Rewrite the expression using inverse cosine

We have .

Step 4: Find the angle whose cosine is

We know that . Since lies within the principal value branch of , which is , it is a valid solution.

Step 5: Check if the angle is within the range of inverse secant

Since lies in the interval and is not equal to , it is within the principal value branch of .

Final Answer: The principal value of is .

ANSWER

(π)/(6)

Question 8

QUESTION

Find the principal value of \cot^-1(√3).

SOLUTION

We are asked to find the principal value of .

Step 1: Understand the range of the principal value of

The principal value of lies in the interval . This means we are looking for an angle such that and .

Step 2: Recall the values of cotangent for standard angles

We know that .

Step 3: Check if the angle lies within the principal value range

Since lies in the interval , it is a valid principal value.

Step 4: Write the final answer

Therefore, the principal value of is .

ANSWER

(π)/(6)

Question 9

QUESTION

Find the principal value of \cos^-1\left(-(1)/(√2)\right).

SOLUTION

We are asked to find the principal value of the inverse cosine function, .

Step 1: Understand the range of the principal value of

The principal value range of is . This means the answer must lie between 0 and (inclusive).

Step 2: Let

This implies that .

Step 3: Find the angle in the range such that

We know that . Since the cosine function is negative, the angle must be in the second quadrant.

Step 4: Determine the angle in the second quadrant

In the second quadrant, the angle can be expressed as , where is the reference angle.

In this case, , so .

Step 5: Calculate

Since lies within the range , this is the principal value.

Final Answer: The principal value of is .

ANSWER

(3π)/(4)

Question 10

QUESTION

Find the principal value of \textcosec^-1(-√2).

SOLUTION

We need to find the principal value of . This involves understanding the range of the inverse cosecant function.

Step 1: Define the inverse cosecant function

The inverse cosecant function, denoted as , gives the angle whose cosecant is . The range of the principal value branch of is .

Step 2: Set up the equation

Let . This means .

Step 3: Find the angle whose cosecant is

We know that . Since we need , we look for an angle in the range where the cosecant is negative.

Since cosecant is the reciprocal of sine, . Cosecant is negative in the third and fourth quadrants. However, our range is restricted to , which corresponds to the first and fourth quadrants.

Therefore, we consider the fourth quadrant. We know that , which means .

Step 4: Check if the angle is within the principal value range

The angle lies within the range .

Step 5: State the principal value

Therefore, the principal value of is .

Final Answer:

ANSWER

-(π)/(4)

Question 11

QUESTION

Find the value of \tan^-1(1) + \cos^-1\left(-(1)/(2)\right) + \sin^-1\left(-(1)/(2)\right).

SOLUTION

We need to find the value of the expression . This involves evaluating inverse trigonometric functions and then summing the results.

Step 1: Evaluate

We need to find an angle whose tangent is 1. We know that . Since the range of is , we have:

Step 2: Evaluate

We need to find an angle whose cosine is . We know that . Since the range of is , we have:

Step 3: Evaluate

We need to find an angle whose sine is . We know that . Since the range of is , we have:

Step 4: Sum the results

Now we add the values we found in the previous steps:

Step 5: Simplify the sum

To add these fractions, we need a common denominator, which is 12:

Final Answer:

ANSWER

(3π)/(4)

Question 12

QUESTION

Find the value of \cos^-1\left((1)/(2)\right) + 2\sin^-1\left((1)/(2)\right).

SOLUTION

We need to find the value of the expression .

Step 1: Find the value of

We need to find an angle such that . We know that . Since the range of is , lies within this range. Therefore, .

Step 2: Find the value of

We need to find an angle such that . We know that . Since the range of is , lies within this range. Therefore, .

Step 3: Substitute the values into the expression

Now we substitute the values we found in steps 1 and 2 into the given expression:

Step 4: Simplify the expression

Final Answer: The value of is .

ANSWER

(2π)/(3)

Question 13

QUESTION

If \sin^-1 x = y, then which of the following is correct?

(A) 0 \le y \le π

(B) -(π)/(2) \le y \le (π)/(2)

(C) 0 < y < π

(D) -(π)/(2) < y < (π)/(2)

SOLUTION

The question asks us to identify the correct range (or principal value branch) of given that .

Step 1: Recall the definition of inverse trigonometric functions

The inverse trigonometric functions are defined to give a unique output for a given input. This is achieved by restricting their ranges.

Step 2: Consider the sine function

The sine function, , takes an angle as input and returns a value between -1 and 1. The inverse sine function, , does the opposite: it takes a value between -1 and 1 as input and returns an angle as output.

Step 3: Determine the range of

The range of (also known as the principal value branch) is defined as . This means that the output of must lie between and , inclusive.

In other words, .

Step 4: Analyze the given options

Option (A): is the range of , not .

Option (B): is the correct range for .

Option (C): is the range of neither nor . It also uses strict inequalities.

Option (D): is incorrect because it uses strict inequalities; the values and are included in the range of .

Final Answer:

The correct answer is (B) .

ANSWER

B

Question 14

QUESTION

Find the value of \tan^-1(√3) - \sec^-1(-2).

(A) π

(B) -(π)/(3)

(C) (π)/(3)

(D) (2π)/(3)

SOLUTION

We need to find the value of the expression . This question tests our knowledge of the principal value branches of inverse trigonometric functions.

Step 1: Find the value of

We know that the principal value branch of is .

We need to find an angle in this interval such that .

We know that , and lies in the interval .

Therefore, .

Step 2: Find the value of

The principal value branch of is .

We need to find an angle in this interval such that .

Since , we have .

We know that , and lies in the interval .

Therefore, .

Step 3: Calculate the expression

Now we can substitute the values we found:

Final Answer: The value of is .

Therefore, the correct option is (B).

ANSWER

B

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📐 Key Formulas

Important Formulas for Exercise 2.1

Formula / Concept	Description
Inverse Trigonometric Functions	Functions that provide the angle for a given trigonometric ratio. For example, if $\sin(\theta) = x$, then $\theta = \sin^{-1}(x)$. They are also known as arc functions (e.g., arcsin(x)).
Principal Value Branch	To make inverse trigonometric functions true functions (one-to-one), their ranges are restricted to a specific interval. This restricted range is called the Principal Value Branch. The value of the function within this range is the principal value.
Domain and Principal Value Range	

Function	Domain	Range (Principal Value Branch)
$y = \sin^{-1}(x)$	$[-1, 1]$	$\left[-\frac{\pi}{2}, \frac{\pi}{2} \right]$
$y = \cos^{-1}(x)$	$[-1, 1]$	$[0, \pi]$
$y = \csc^{-1}(x)$	$\mathbb{R} - (-1, 1)$	$\left[-\frac{\pi}{2}, \frac{\pi}{2} \right] - \{0\}$
$y = \sec^{-1}(x)$	$\mathbb{R} - (-1, 1)$	$[0, \pi] - \left\{\frac{\pi}{2}\right\}$
$y = \tan^{-1}(x)$	$\mathbb{R}$	$\left(-\frac{\pi}{2}, \frac{\pi}{2} \right)$
$y = \cot^{-1}(x)$	$\mathbb{R}$	$(0, \pi)$

Formula / Concept	Description
Properties for Negative Inputs	
$\sin^{-1}(-x) = -\sin^{-1}(x)$	Valid for $x \in [-1, 1]$.
	Valid for $x \in [-1, 1]$.

Formula / Concept	Description
$\cos^{-1}(-x) = \pi - \cos^{-1}(x)$	
$\tan^{-1}(-x) = -\tan^{-1}(x)$	Valid for $x \in \mathbb{R}$.
$\csc^{-1}(-x) = -\csc^{-1}(x)$	Valid for $\|x\| \ge 1$.
$\sec^{-1}(-x) = \pi - \sec^{-1}(x)$	Valid for $\|x\| \ge 1$.
$\cot^{-1}(-x) = \pi - \cot^{-1}(x)$	Valid for $x \in \mathbb{R}$.
Composition Properties	
$\sin(\sin^{-1}(x)) = x$ $\cos(\cos^{-1}(x)) = x$	For $x \in [-1, 1]$.
$\tan(\tan^{-1}(x)) = x$	For any real number x.
$\sin^{-1}(\sin(y)) = y$	For $y \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$.
$\cos^{-1}(\cos(y)) = y$	For $y \in [0, \pi]$.
$\tan^{-1}(\tan(y)) = y$	For $y \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$.

❓ Top FAQs

Q1. How many questions are in NCERT Solutions Class 12 Maths Chapter 2 Inverse Trigonometric Functions Exercise 2.1?

Exercise 2.1 of NCERT Solutions for Class 12 Maths Chapter 2 Inverse Trigonometric Functions contains exactly 14 questions. These questions cover fundamental concepts like principal value branches and basic properties of inverse trigonometric functions. All 14 questions with step by step solutions are available for free PDF download for CBSE board exam 2025-26 preparation.

Q2. Where can I download free PDF of NCERT Solutions for Class 12 Maths Chapter 2 Inverse Trigonometric Functions Exercise 2.1?

Free PDF download of NCERT Solutions for Class 12 Maths Chapter 2 Inverse Trigonometric Functions Exercise 2.1 is available on the official NCERT website and various educational platforms. These step by step solutions are updated according to the CBSE board exam 2025-26 syllabus. The PDF includes all 14 questions with detailed explanations of principal value branch concepts and properties of inverse trig functions.

Q3. How many marks does Inverse Trigonometric Functions carry in CBSE Class 12 Maths board exam 2025-26?

Inverse Trigonometric Functions (Chapter 2) carries 4 marks weightage in CBSE Class 12 Maths board exam 2025-26 as part of Unit I - Relations and Functions. This weightage is shared with other topics in the unit. Students should thoroughly practice NCERT Solutions for Class 12 Maths Chapter 2 Exercise 2.1 to score well in this section.

Q4. Which is the most difficult question in NCERT Solutions Class 12 Maths Chapter 2 Inverse Trigonometric Functions Exercise 2.1?

Questions 11-14 in Exercise 2.1 of Class 12 Maths Chapter 2 Inverse Trigonometric Functions are considered most challenging as they involve complex principal value calculations. These questions require understanding of multiple properties of inverse trig functions simultaneously. Step by step solutions for these difficult questions are essential for CBSE board exam 2025-26 preparation and free PDF downloads are recommended.

Q5. What are the properties of inverse trigonometric functions covered in NCERT Solutions Class 12 Maths Chapter 2 Exercise 2.1?

Exercise 2.1 of NCERT Solutions for Class 12 Maths Chapter 2 covers fundamental properties including principal value branches, domain and range of inverse trig functions, and basic identities. The 14 questions systematically introduce $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, $\cot^{-1}$, $\sec^{-1}$, and cosec^{-1} functions. These concepts are crucial for CBSE board exam 2025-26 and students should practice step by step solutions thoroughly.

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