The Value Of Cos X Is Given. Find Tan X And Sin Xif X Lies In The Specified Interval. 31 4 COS X=- 5

The Value Of Cos X Is Given. Find Tan X And Sin X If X Lies In The Specified Interval. 31 4 COS X = - 5

Introduction

In trigonometry, it is common to be given certain values of a trigonometric function and asked to find other related functions. This process often involves understanding the relationships between the sine, cosine, and tangent functions, as well as considering the interval or quadrant in which the angle lies.

The problem statement suggests that the cosine of angle X, scaled by some factor, equals -5. Our goal is to find the tangent and sine of X, given this information, and considering the specified interval, which appears to be "31 4" — likely a typo or formatting error, but possibly intended to specify an interval or a particular range for X.

In this article, we will interpret and analyze the problem step by step, applying fundamental trigonometric identities and principles to arrive at the solution.

Understanding the Given Data

Deciphering the Expression

The problem states: "The value of cos X is given. Find tan X and sin X if X lies in the specified interval. 31 4 cos X = -5."

The phrase "31 4 cos X = -5" appears ambiguous. It could be a misprint or formatting issue. Possible interpretations include:

- "3/4 cos X = -5"
- "3.14 cos X = -5" (less likely, as 3.14 is pi)
- "31/4 cos X = -5"

Given the context, the most plausible interpretation is:

$(3/4) \times \cos X = -5$

which simplifies to:

$$ \frac{3}{4} \cos X = -5 $$

This makes sense because it involves a scalar multiple of cos X.

Thus, the key relation is:

$$
\frac{3}{4} \cos X = -5
$$

Calculating Cos X

Isolating cos X

From the relation:

$$
\frac{3}{4} \cos X = -5
$$

Multiply both sides by 4/3:

$$
\cos X = -5 \times \frac{4}{3} = -\frac{20}{3}
$$

Result:

$$
\boxed{
\cos X = -\frac{20}{3}
}
$$

Analyzing the Validity of Cos X

Recall that the cosine of any real angle X must satisfy:

$$
-1 \leq \cos X \leq 1
$$

But here, $\cos X = -\frac{20}{3} \approx -6.666...$, which is not within the valid range for cosine.

Implication:

This indicates that either the interpretation of the given data is incorrect, or the problem is hypothetical, possibly testing the recognition of invalid scenarios.

Addressing the Contradiction

Since the computed cosine exceeds the physical bounds of the cosine function, the problem suggests that the initial assumption about "3/4 cos X = -5" is invalid for real angles.

Possible resolutions:

1. The problem might contain a typo or formatting errors.
2. The given data could be from a different context (e.g., complex numbers or hypothetical scenarios).
3. The problem might be intentionally designed to point out that no real solutions exist under these conditions.

Alternative Interpretation: Considering the Interval

Suppose the interval specified in the problem is a typo, and the actual interval is X in [0, 2π] or a similar range. Or perhaps "31 4" is a misprint for "π/4" (pi over 4), which is a common interval reference in trigonometry.

If we interpret "31 4" as π/4, then:

- The interval is $X \in \left[0, \frac{\pi}{2}\right]$ or similar.

But since the prior calculation yields an invalid cosine, perhaps the problem intends for us to find a consistent set of values based on different data.

Revisiting the Problem with Corrected Data

Given the difficulties, let's assume the intended problem is:

"Given $\cos X = -\frac{4}{5}$, find $\sin X$ and $\tan X$ if X lies in the specified interval."

This is a common trigonometric problem, and the numbers fit within the valid range for cosine.

Calculating Sin X

Using the Pythagorean identity:

$$
\sin^2 X + \cos^2 X = 1
$$

Substitute $\cos X = -\frac{4}{5}$:

$$
\sin^2 X + \left(-\frac{4}{5}\right)^2 = 1
$$
$$
\sin^2 X + \frac{16}{25} = 1
$$
$$
\sin^2 X = 1 - \frac{16}{25} = \frac{25}{25} - \frac{16}{25} = \frac{9}{25}
$$

Hence:

$$
\sin X = \pm \frac{3}{5}
$$

Determining the sign of $\sin X$:

- If X is in the second quadrant ($\pi/2 < X < \pi$), then $\sin X > 0$, $\cos X < 0$.
- If X is in the third quadrant ($\pi < X < 3\pi/2$), then $\sin X < 0$, $\cos X < 0$.

Suppose the interval is in the second quadrant, then:

$$
\sin X = \frac{3}{5}
$$

Calculating Tan X

$$
\tan X = \frac{\sin X}{\cos X}
$$

Using the positive sine:

$$
\tan X = \frac{\frac{3}{5}}{-\frac{4}{5}} = -\frac{3}{4}
$$

Final Results

Assuming the corrected data $\cos X = -\frac{4}{5}$, then:

- $\sin X = \frac{3}{5}$ (for the second quadrant)
- $\tan X = -\frac{3}{4}$

Summary of Approach and Key Points

- Understanding the importance of valid ranges for trigonometric functions.
- Using fundamental identities such as $\sin^2 X + \cos^2 X = 1$.
- Considering the quadrant based on the signs of sine and cosine.
- Applying the tangent definition as $\tan X = \frac{\sin X}{\cos X}$.

Conclusion

The problem initially presents some ambiguous or inconsistent data, but by interpreting it within the standard bounds of trigonometric functions and typical problem structures, we can derive meaningful solutions.

If the initial data is corrected or clarified, the process involves:

- Isolating the cosine value.
- Using Pythagorean identities to find sine.
- Determining the sign of sine based on the interval.
- Calculating tangent using the ratio of sine to cosine.

Understanding these steps is foundational in trigonometry and essential for solving a broad class of problems involving angles and their trigonometric functions.

Note on the Importance of Accurate Data

When tackling trigonometric problems, always ensure the given data is within the valid ranges of the functions. Invalid values often indicate either a different context (complex numbers, hypothetical scenarios) or errors in the problem statement.

In real-world applications and examinations, recognizing such inconsistencies is crucial to avoid incorrect conclusions.

End of Article

Frequently Asked Questions

Given that 4 cos x = -5, find the value of tan x if x lies in the specified interval.

First, solve for cos x: $\cos x = -5/4$. Since $|\cos x|$ cannot be greater than 1, this indicates an inconsistency, suggesting the given value is invalid or the interval is outside the domain. Therefore, no real solution exists for tan x under these conditions.

If 4 cos x = -5 and x is in the interval where cosine is negative, how do you find sin x?

Given the invalid value for cos x (since $|\cos x| > 1$), sin x cannot be determined reliably. In a valid scenario, you'd use $\sin x = \pm\sqrt{1 - \cos^2 x}$, but here, since cos x is outside [-1, 1], the problem has no real solution.

What is the significance of the interval in determining the

values of sin x and tan x given the value of cos x?

The interval specifies the range of x (e.g., quadrants) which helps determine the signs of sin x and tan x. However, if the given cos x value is invalid (outside [-1, 1]), the interval becomes irrelevant as no real solutions exist.

Can cos x be -5/4? Why or why not?

No, cos x cannot be -5/4 because the cosine of any real angle must be between -1 and 1. Since -5/4 < -1, this indicates an invalid or impossible value for cos x.

Assuming a correction where 4 cos x = -4, find tan x and sin x in the specified interval.

If 4 cos x = -4, then cos x = -1. In this case, sin x = 0, and tan x = sin x / cos x = 0 / -1 = 0. The specific interval (e.g., x in π or 3π/2) determines the sign, but with cos x = -1, x = π, so sin x = 0 and tan x = 0.

How do you verify if the given value of cos x is valid before calculating tan x and sin x?

Check if the value of cos x lies within the range [-1, 1]. If it exceeds this range, the value is invalid for real angles, and no real solutions for tan x and sin x can be obtained.

Additional Resources

The Value Of Cos X Is Given. Find Tan X And Sin X If X Lies In The Specified Interval. 31 4 COS X= - 5

Understanding the relationships between the trigonometric functions is fundamental in solving a wide range of mathematical problems, especially those involving angles and their ratios. The problem statement "The value of cos x is given. Find tan x and sin x if x lies in the specified interval. 31 4 cos x = -5" presents a typical trigonometric challenge that requires a systematic approach to decipher the values of various functions based on given information and interval constraints. This article aims to comprehensively analyze this problem, elucidate the concepts involved, and guide you through the solution process with clarity and detail.

Understanding the Problem Statement

Before delving into calculations, it’s crucial to understand what the problem entails:

- We are given a value related to the cosine function: cos x = -5/4 (interpreting "31 4 COS X = -5" as a typo or misprint, assuming it should be a fraction, i.e., -5/4).
- We need to find the corresponding values of sin x and tan x.
- The angle x lies within a specified interval, which typically constrains the possible values of sine,

cosine, and tangent functions.

Key points:
- Since cosine is given as -5/4, which is outside the permissible range of cosine function values (which must lie between -1 and 1), the problem seems inconsistent at first glance.
- This discrepancy hints at either a typo or a need to interpret the problem differently, perhaps as a different value or context.

Addressing the Potential Typo or Misinterpretation

Given that cos x = -5/4 is outside the normal range of cosine (~[-1, 1]), it’s essential to analyze the possibility of an error in the problem statement:

- Possibility 1: The number 31 4 might be meant as 3/4, and the statement could be cos x = -3/4.
- Possibility 2: The problem could involve a different value, or perhaps the negative sign is misplaced.

Assuming the intended problem is:

> "Given cos x = -3/4, find tan x and sin x if x lies within the specified interval."

This assumption aligns with standard trigonometric principles and makes the problem solvable.

Fundamental Concepts and Trigonometric Identities

To solve the problem, it’s essential to recall key identities:

- Pythagorean Identity:
$$ \sin^2 x + \cos^2 x = 1 $$
- Definition of tangent:
$$ \tan x = \frac{\sin x}{\cos x} $$

Knowing cos x, we can find sin x using the Pythagorean identity, provided the interval constraints inform us about the sign of sin x.

Analyzing the Given Data: Assuming cos x = -3/4

Step 1: Find sin x

Using the Pythagorean identity:

$$
\sin^2 x = 1 - \cos^2 x
$$

Substitute $\cos x = -\frac{3}{4}$:

$$
\sin^2 x = 1 - \left(-\frac{3}{4}\right)^2 = 1 - \frac{9}{16} = \frac{16}{16} - \frac{9}{16} = \frac{7}{16}
$$

Thus,

$$
\sin x = \pm \sqrt{\frac{7}{16}} = \pm \frac{\sqrt{7}}{4}
$$

Step 2: Determine the sign of sin x

The sign of sin x depends on the interval where x lies:

- If x is in the second quadrant (90° to 180°, or $\frac{\pi}{2}$ to π), sine is positive.
- If x is in the third quadrant (180° to 270°, or π to $\frac{3\pi}{2}$), sine is negative.

The problem states: "if x lies in the specified interval", which might be, for example, between $\frac{\pi}{2}$ and π, typically the second quadrant, where sine is positive.

Suppose the interval is the second quadrant:

$$
\sin x = \frac{\sqrt{7}}{4}
$$

Calculating tan x

Using the definition:

$$
\tan x = \frac{\sin x}{\cos x}
$$

Substitute the known values:

$$
\tan x = \frac{\frac{\sqrt{7}}{4}}{-\frac{3}{4}} = \frac{\sqrt{7}}{4} \times \frac{-4}{3} = -

\frac{\sqrt{7}}{3}
\]

Result:

\[
\boxed{
\sin x = \frac{\sqrt{7}}{4}
}
\]

\[
\boxed{
\tan x = -\frac{\sqrt{7}}{3}
}
\]

Summary of Solutions

Quantity	Value	Sign Considerations	Notes
\(\sin x\)	\(\frac{\sqrt{7}}{4}\)	Positive (second quadrant assumption)	Derived from Pythagoras
\(\cos x\)	\(-\frac{3}{4}\)	Given	Provided in problem
\(\tan x\)	\(-\frac{\sqrt{7}}{3}\)	Negative	Sign depends on quadrant

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Significance of the Quadrant and Interval

The sign of sine and tangent functions heavily depends on the quadrant in which the angle \(x\) resides. Here's a quick guide:

- Quadrant I (0 to 90° / 0 to \(\frac{\pi}{2}\)): \(\sin x > 0\), \(\cos x > 0\), \(\tan x > 0\)
- Quadrant II (90° to 180° / \(\frac{\pi}{2}\) to \(\pi\)): \(\sin x > 0\), \(\cos x < 0\), \(\tan x < 0\)
- Quadrant III (180° to 270° / \(\pi\) to \(\frac{3\pi}{2}\)): \(\sin x < 0\), \(\cos x < 0\), \(\tan x > 0\)
- Quadrant IV (270° to 360° / \(\frac{3\pi}{2}\) to \(2\pi\)): \(\sin x < 0\), \(\cos x > 0\), \(\tan x < 0\)

Given \(\cos x = -3/4\), and assuming the sine is positive, the angle \(x\) is in the second quadrant.

Implications of the Interval Specification

The interval specifies the allowable range for \(x\), which influences the signs of \(\sin x\) and \(\tan x\). For example:

- If the interval is \(\left(\frac{\pi}{2}, \pi\right)\), the calculated signs align with the second quadrant.
- If the interval is different, such as the third or fourth quadrants, signs of sine and tangent would change accordingly.

Potential Variations and Additional Considerations

While the above solution assumes the corrected value \(\cos x = -3/4\), it's essential to note:

- If the original problem's value was different or involved more complex expressions, the approach would need to adapt.
- The interval's explicit bounds are critical in determining the correct signs and quadrants.
- In some cases, the problem might involve inverse functions or additional constraints.

Features, Pros, and Cons of the Approach

Features:

- Systematic use of fundamental identities simplifies problem-solving.
- Clear understanding of quadrants aids in sign determination.
- Step-by-step approach makes the solution accessible.

Pros:

- Easy to adapt for similar problems with different given values.
- Reinforces understanding of basic trigonometric identities.
- Highlights the importance of interval constraints in sign determination.

Cons:

- Assumes correction of potential typos; real problems may have different complexities.
- Requires prior knowledge of trigonometric identities and quadrant rules.
- Sign ambiguity can sometimes lead to multiple valid solutions unless interval constraints are explicit.

Conclusion

The problem of finding \(\tan x\) and \(\sin x\) given \(\cos x\) and the interval constraints exemplifies core principles of trigonometry. Assuming the most plausible correction (i.e., \(\cos x = -3/4\)), the solution involves applying the Pythagorean identity, considering the quadrant based on the interval, and calculating the respective values with attention to signs. Such problems demonstrate the interconnected

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