Given That 5 Cos (x+8.5) - 1 = 0 0 X 90, Calculate Correct To The Nearest Degree, The Value Of X.

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Understanding and solving trigonometric equations is a fundamental skill in mathematics, especially in fields such as engineering, physics, and geometry. The problem presented — "Given that 5 Cos (x + 8.5) - 1 = 0 0 X 90, calculate correct to the nearest degree, the value of X" — appears to involve a trigonometric equation with a cosine function and an angle measurement, requiring precise calculation and interpretation of the problem statement.

In this article, we will explore the steps to solve this problem systematically, providing detailed explanations, relevant formulas, and tips to understand the underlying concepts. We will also discuss how to handle trigonometric equations involving transformations and how to interpret questions that specify the range and accuracy of the solutions.

Understanding the Problem Statement

Before diving into the solution, it's crucial to interpret the problem accurately. The statement as given is:

"Given That 5 Cos (x + 8.5) - 1 = 0 0 X 90, Calculate Correct To The Nearest Degree, The Value Of X."

At first glance, the expression appears ambiguous or possibly contains typographical errors. Let's analyze potential interpretations:

1. Equation Focus:

The core part of the equation seems to be:

$$
5 \cos (x + 8.5) - 1 = 0
$$

which is a typical trigonometric equation involving cosine.

2. Range or Domain Indicator:

The part "0 0 X 90" likely indicates an angle range or domain for x, probably meaning "from 0 to 90 degrees" or "X between 0° and 90°."

3. Additional Meaning:

The 'X' might be a variable or placeholder, or perhaps a misprint for 'to' or 'and.'

Based on common mathematical notation, a reasonable interpretation of the problem is:

> Given the equation $5 \cos (x + 8.5^\circ) - 1 = 0$, find the value(s) of x (in degrees), within the range $0^\circ \leq x \leq 90^\circ$, correct to the nearest degree.

This interpretation aligns with typical trigonometric problem formats.

Reformulating the Problem

Assuming the above interpretation, the problem simplifies to:

Find the value(s) of x in the range $0^\circ \leq x \leq 90^\circ$ such that:

$$
5 \cos (x + 8.5^\circ) - 1 = 0
$$

and round the solution to the nearest degree.

Step-by-Step Solution Approach

To solve this equation, we will follow these steps:

1. Isolate the cosine term.
2. Solve for the cosine value.
3. Find the related angles.
4. Determine solutions within the specified range.
5. Round to the nearest degree.

Let's proceed methodically.

Step 1: Isolate the cosine function

Starting with:

$$
5 \cos (x + 8.5^\circ) - 1 = 0
$$

Add 1 to both sides:

$$
5 \cos (x + 8.5^\circ) = 1
$$

Divide both sides by 5:

$$
\cos (x + 8.5^\circ) = \frac{1}{5} = 0.2
$$

This is a straightforward cosine equation.

Step 2: Solve for the angle $\theta = x + 8.5^\circ$

Set:

$$
\theta = x + 8.5^\circ
$$

So:

$$
\cos \theta = 0.2
$$

The general solutions for:

$$
\cos \theta = 0.2
$$

are:

$$
\theta = \arccos(0.2) \quad \text{or} \quad \theta = 360^\circ - \arccos(0.2)
$$

Calculating $\arccos(0.2)$:

$$
\arccos(0.2) \approx 78.46^\circ
$$

Therefore, the two solutions for θ are:

$$
\theta_1 = 78.46^\circ
$$

$$
\theta_2 = 360^\circ - 78.46^\circ = 281.54^\circ
$$

Step 3: Find corresponding x values

Recall:

$$
x = \theta - 8.5^\circ
$$

Substituting:

- For $\theta_1 = 78.46^\circ$:

$$
x_1 = 78.46^\circ - 8.5^\circ = 69.96^\circ
$$

- For $\theta_2 = 281.54^\circ$:

$$
x_2 = 281.54^\circ - 8.5^\circ = 273.04^\circ
$$

Step 4: Determine which solutions are within the specified range

The problem specifies solutions within $0^\circ \leq x \leq 90^\circ$.

- $x_1 \approx 69.96^\circ$ — within range

- $x_2 \approx 273.04^\circ$ – outside range

Since x must be between 0° and 90°, only x_1 applies.

Step 5: Round to the nearest degree

The solution:

$$
x \approx 69.96^\circ
$$

Rounding to the nearest degree:

$$
x \approx \boxed{70^\circ}
$$

Final Answer

The value of x, correct to the nearest degree, is 70°.

Additional Considerations and Tips

- Understanding the Range:
Always verify whether multiple solutions exist within the specified domain. Cosine functions are periodic with a period of 360°, so for equations involving cosine, multiple solutions can arise, but only those within the given range are valid.

- Use of Calculator:
When calculating $\arccos(0.2)$, ensure your calculator is set to degrees to match the problem's units.

- Handling Ambiguities:
If the problem statement contains typographical errors or ambiguous parts, clarify or interpret based on common conventions, as demonstrated here.

- Approximate Solutions:
When solutions involve irrational or non-terminating decimals, round appropriately, especially when the question asks for the nearest degree.

Conclusion

Solving trigonometric equations such as $5 \cos (x + 8.5^\circ) - 1 = 0$ involves understanding inverse trigonometric functions, general solutions, and domain restrictions. By isolating the cosine term and applying the inverse cosine function, we identified the primary solutions, then selected those within the specified domain. Rounding the final answer to the nearest degree yielded 70° as the solution.

Mastering these techniques enhances problem-solving skills in trigonometry and prepares students for more complex mathematical challenges. Always double-check your solutions within the context of the problem, and remember that understanding the underlying concepts is key to success in mathematics.

Frequently Asked Questions

How do I solve the equation 5 cos(x + 8.5) - 1 = 0 for x within 0° to 90°?

First, isolate cos(x + 8.5): 5 cos(x + 8.5) = 1, so cos(x + 8.5) = 1/5 = 0.2. Then, find the angle(s) where cos(□) = 0.2, and subtract 8.5 from those to find x. Finally, select the solutions within 0° to 90° and round to the nearest degree.

What is the first step to find x in the equation 5 cos(x + 8.5) - 1 = 0?

Rearrange the equation to isolate cos(x + 8.5): 5 cos(x + 8.5) = 1, then divide both sides by 5 to get cos(x + 8.5) = 0.2.

How do I find the inverse cosine of 0.2 to solve for x?

Use a calculator to compute arccos(0.2). Make sure your calculator is in degree mode. arccos(0.2) □ 78.46°. This is the principal value for x + 8.5.

Once I find arccos(0.2), how do I determine the value of x?

Subtract 8.5 from the arccos result: x + 8.5 □ 78.46°, so x □ 78.46° - 8.5° □ 69.96°. Round to the nearest degree: x □ 70°.

Are there multiple solutions for x in this equation within 0° to 90°?

Since cosine is positive and decreasing in the first quadrant, only one solution within 0° to 90° exists in this context, which is approximately 70° after rounding.

Why is it important to convert the angle to degrees when solving this problem?

Because the problem asks for the value of x to the nearest degree, so using degrees ensures the answer aligns with the required precision.

What should I do if my calculator gives an answer outside 0° to 90°?

Check the value of the inverse cosine. If outside 0° to 90°, consider the cosine's symmetry and principal value. For this problem, only solutions within 0° to 90° are relevant, so adjust accordingly or discard invalid solutions.

Can I verify my solution for x by substituting back into the original equation?

Yes, substitute x ≈ 70° into the original equation: compute cos(70 + 8.5) and verify if 5 times that minus 1 equals zero. This helps confirm the correctness of your solution.

Additional Resources

Given That 5 Cos (x + 8.5) - 1 = 0, Calculate Correct To The Nearest Degree, The Value Of X

Introduction

In the realm of trigonometry, equations involving cosine functions are fundamental, often serving as the backbone of numerous mathematical, scientific, and engineering applications. The problem at hand—"Given that 5 Cos (x + 8.5) - 1 = 0, calculate correct to the nearest degree, the value of x"—is a classic example that combines algebraic manipulation with an understanding of trigonometric functions. This article aims to dissect this problem comprehensively, providing detailed explanations, methodical steps, and contextual insights to ensure clarity and mastery of the concepts involved.

Understanding the Problem

The core equation:

$$ 5 \cos(x + 8.5) - 1 = 0 $$

This equation involves a cosine function with a phase shift (x + 8.5) and a coefficient of 5 multiplying the cosine value. The goal is to solve for x, with the resulting value rounded to the nearest degree.

Key points to consider:

- The angle inside the cosine function is $x + 8.5$.
- The coefficient of 5 indicates the amplitude or scaling factor.
- The equation equates to zero, implying a specific value of cosine.

Step 1: Isolate the Cosine Function

The first step in solving the equation is to isolate the cosine term:

$$
5 \cos(x + 8.5) - 1 = 0
$$

Add 1 to both sides:

$$
5 \cos(x + 8.5) = 1
$$

Divide both sides by 5:

$$
\cos(x + 8.5) = \frac{1}{5}
$$

This simplification allows us to focus on solving for the angle $x + 8.5$ directly.

Step 2: Find the General Solution for $\cos \theta = \frac{1}{5}$

Let:

$$
\theta = x + 8.5
$$

Then:

$$
\cos \theta = \frac{1}{5} = 0.2
$$

Understanding the cosine function:

- The cosine function ranges between -1 and 1.

- $\cos \theta = 0.2$ is within this range, so real solutions exist.
- The cosine function is positive in the first and fourth quadrants, leading to two solutions per cycle.

Finding the principal value:

Using a calculator, find the inverse cosine:

$$
\theta_0 = \cos^{-1}(0.2)
$$

Calculating:

$$
\theta_0 \approx \cos^{-1}(0.2) \approx 78.46^\circ
$$

(Note: The calculator should be in degree mode for this calculation.)

Step 3: Determine All Possible Solutions

The cosine function's symmetry implies that:

$$
\cos \theta = \cos (360^\circ - \theta)
$$

Thus, the solutions for θ are:

1. $\theta_1 = 78.46^\circ$

2. $\theta_2 = 360^\circ - 78.46^\circ = 281.54^\circ$

Note: Since cosine is periodic with a period of 360°, the general solutions are:

$$
\theta = \theta_0 + 360^\circ k
$$

and

$$
\theta = -\theta_0 + 360^\circ k
$$

where k is any integer.

But because our problem asks for the specific value of x (and thus θ) to the nearest degree, we focus on these primary solutions.

Step 4: Solve for x

Recall:

$$
x + 8.5 = \theta
$$

Therefore:

\[

$$
x = \theta - 8.5
$$

Using the principal solutions:

- For $\theta_1 = 78.46^\circ$:

$$
x = 78.46^\circ - 8.5^\circ \approx 69.96^\circ
$$

- For $\theta_2 = 281.54^\circ$:

$$
x = 281.54^\circ - 8.5^\circ \approx 273.04^\circ
$$

Step 5: Considering the Range of x

In many trigonometric problems, the domain of x isn't explicitly specified. The solutions above are valid solutions within the principal cycle. Depending on the context, solutions can be extended to multiple cycles by adding $360^\circ \times k$.

For the current problem:

- The solutions to the nearest degree are approximately:

- First solution: $x \approx 70^\circ$
- Second solution: $x \approx 273^\circ$

- If the question requires solutions within a specific range, such as $0^\circ \leq x < 360^\circ$, these two solutions suffice.

Additional Solutions in Multiple Cycles

If the problem intends for all possible solutions over multiple periods, then:

$$
x = \theta - 8.5 + 360^\circ k
$$

for integer k, which would generate an infinite set of solutions.

However, most standard problems focus on solutions within a single cycle (0° to 360°), so the two primary solutions are typically sufficient.

Summary of Key Results

Solution Number	θ (degrees)	$x = \theta - 8.5$ (degrees)	Rounded to nearest degree
1	78.46	69.96	70
2	281.54	273.04	273

Additional Insights:

1. Nature of Cosine Solutions:

The cosine function's symmetry around the vertical axis results in two solutions within each period. This symmetry plays a crucial role in solving equations like the one presented.

2. Impact of Phase Shift:

The addition of 8.5 degrees inside the cosine argument effectively shifts the standard cosine graph horizontally. It influences the specific solutions for x but doesn't alter the fundamental properties of the cosine function.

3. Precision and Rounding:

The solutions are calculated precisely and then rounded to the nearest degree, as per the problem's instructions. This is typical in many real-world applications where exact decimal degrees are less practical.

4. Relevance in Real-World Contexts:

Equations of this form appear in disciplines like physics (wave motion), engineering (signal processing), and astronomy (celestial navigation). Understanding how to solve such equations accurately is essential for precise measurements and predictions.

Conclusion

The problem of solving the equation $5 \cos(x + 8.5) - 1 = 0$ exemplifies fundamental trigonometric principles. By isolating the cosine term, calculating the inverse cosine, and considering the symmetry of the cosine function, we identified two primary solutions for x. When rounded to the nearest degree, these are approximately 70° and 273°.

This process underscores the importance of understanding the properties of trigonometric functions, the significance of phase shifts, and the necessity of considering multiple solutions across different cycles. Mastery of such techniques is vital for students, educators, and professionals engaged in fields that rely heavily on precise mathematical modeling.

In essence, the solution reveals that \(x\) can be approximately 70° or 273°, rounded to the nearest degree, within the standard principal domain. Such problems exemplify the elegance and utility of trigonometry in solving real-world and theoretical challenges alike.

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