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Understanding the relationships between angles is a fundamental aspect of geometry, especially when dealing with supplementary and complementary angles. This article delves into a specific problem involving an acute angle and its supplementary angle, providing a comprehensive guide to solving for the measure of the angle in terms of the variable x. Whether you're a student preparing for exams or someone seeking to strengthen your geometry skills, this detailed explanation will clarify the concepts and methods involved.

Understanding the Basics: Angles and Their Relationships

Before tackling the problem, it’s essential to review some fundamental concepts related to angles:

What Are Angles?

An angle is formed when two rays share a common endpoint called the vertex. Angles are measured in degrees, with common classifications including:

- Acute angles: less than 90°
- Right angles: exactly 90°
- Obtuse angles: greater than 90° but less than 180°
- Straight angles: exactly 180°

Supplementary Angles

Two angles are supplementary if their measures add up to 180°. This relationship is crucial when solving problems involving angles:

- If angle A and angle B are supplementary, then:

$A + B = 180°$

Complementary Angles

Similarly, two angles are complementary if their measures sum to 90°, but this concept is not directly involved in our current problem.

Analyzing the Given Problem

The problem states:

"If the supplement of an acute angle has a measure of (2x + 44), find, in terms of x, the measure of the"

While the sentence seems incomplete, the typical interpretation in such problems is to determine the measure of the original acute angle, given that its supplement measures (2x + 44).

Key points:

- The original angle is acute, meaning its measure is less than 90°.
- Its supplement measures (2x + 44).

Our goal:

- Find the measure of the acute angle in terms of x.

Step-by-Step Solution Approach

To solve this problem, we'll follow these steps:

1. Identify the variables and knowns.
2. Write an equation based on the supplementary angles relationship.
3. Express the original angle in terms of x.
4. Solve for the angle's measure in terms of x.

Step 1: Define the Variables

- Let the measure of the original acute angle be A (in degrees).
- The supplement of this angle is then $180° - A$.

Given:

- The supplement has a measure of $(2x + 44)$.

Therefore:

- $180° - A = 2x + 44$

Step 2: Set Up the Equation

From the supplement relationship:

- $180° - A = 2x + 44$

Rearranged:

- $A = 180° - (2x + 44)$

Simplify:

- $A = 180° - 2x - 44$
- $A = (180 - 44) - 2x$
- $A = 136 - 2x$

Step 3: Verify the Validity of the Angle

Since the original angle A is acute, it must satisfy:

- $0° < A < 90°$

Using the expression:

- $A = 136 - 2x$

Set the inequalities:

1. $A > 0°$

- $136 - 2x > 0$
- $-2x > -136$
- $x < 68$

2. $A < 90°$

- $136 - 2x < 90$
- $-2x < -46$
- $x > 23$

Combining these:

- $23 < x < 68$

This range ensures the original angle remains acute.

Step 4: Final Expression for the Original Angle

The measure of the original acute angle A in terms of x is:

$A = 136 - 2x$

This formula allows you to compute the angle's measure for any value of x within the interval (23, 68).

Additional Insights and Applications

Understanding how to manipulate angles and algebraic expressions is essential for solving many geometric problems. This problem showcases the importance of:

- Setting up equations based on angle relationships
- Using algebra to express unknown quantities
- Applying inequalities to validate the solutions

Such skills are valuable not only in academic contexts but also in real-world scenarios involving design, construction, and navigation.

Related Problems and Practice Exercises

To reinforce the concepts discussed, consider practicing the following problems:

1. Find the measure of an angle if its supplement is (3x + 10), and the angle is right-angled.

2. If the complement of an angle measures (x + 20) degrees, find the measure of the angle in

terms of x.

3. Given that an acute angle's supplement is (2x + 44), and its measure is less than 90°, determine the possible values of x and the measure of the angle.

4. Two angles are supplementary. One measures (5x - 15) degrees, and the other (3x + 25) degrees. Find the value of x and the measures of both angles.

Summary of Key Points

- Supplementary angles sum to 180°.
- When given an algebraic expression for one angle, set up an equation using the supplementary relationship.
- Express the original angle in terms of the variable x.
- Verify that the solution satisfies the conditions of the problem, such as the angle being acute.
- Determine the range of x based on the inequalities for the geometric constraints.

Conclusion

Solving for an angle's measure when given its supplement involves understanding the fundamental relationships between angles and applying algebraic techniques. In this specific problem, recognizing that the supplement of an acute angle is expressed as (2x + 44) allows us to derive a formula for the original angle, A = 136 - 2x. By analyzing inequalities, we ensure the validity of the solution within the context of the problem.

Mastering these methods enhances your problem-solving skills and deepens your understanding of geometric principles. Whether preparing for exams or tackling real-world applications, these techniques form the foundation for effective geometric reasoning.

Frequently Asked Questions

If the supplement of an acute angle measures (2x + 44) degrees, what is the measure of the angle in terms of x?

The angle measures (180 - (2x + 44)) degrees, which simplifies to (136 - 2x) degrees.

Given that the supplement of an acute angle is (2x + 44), and the angle is acute, what is the possible range of x?

Since the angle is acute (less than 90°), (136 - 2x) < 90, leading to x > 23, and since the supplement must be positive, x > -22. Therefore, x > 23.

How do you find the value of x if the supplement of the angle is given as (2x + 44) and the angle is known to be 70°?

Set the supplement equal to 70°, so 2x + 44 = 70. Solving for x gives x = (70 - 44)/2 = 13.

What is the relationship between the angle and its supplement when the supplement is expressed as (2x + 44)?

The original angle is (180 - (2x + 44)) degrees, illustrating that the angle and its supplement sum to 180°, with the angle depending on x as (136 - 2x).

If the supplement of an acute angle is (2x + 44), and the angle itself

is also acute, what inequality must x satisfy?

Since the angle is (136 - 2x) and must be less than 90°, we have 136 - 2x < 90, which simplifies to x > 23.

How can you verify if a specific value of x makes the angle and its supplement valid and acute?

Calculate the angle as (136 - 2x). Ensure that this value is positive and less than 90°. For example, if x=25, then the angle is 136 - 50 = 86°, which is acute, confirming validity.

In terms of x, what is the measure of the original angle if the supplement is (2x + 44)?

The measure of the original angle is (180 - (2x + 44)) = (136 - 2x) degrees.

Additional Resources

If The Supplement Of An Acute Angle Has A Measure Of (2x + 44), Find, In Terms Of X, The Measure Of The

Understanding the relationship between angles is fundamental in geometry, a branch of mathematics that explores shapes, sizes, and the properties of space. When dealing with angles, especially in problems involving supplementary and complementary angles, the key lies in understanding their definitions and how they relate algebraically. This article delves into a specific problem: given that the supplement of an acute angle measures (2x + 44), how can we determine the measure of the angle itself in terms of x? We will explore the foundational concepts, set up the mathematical relationships, and work through the solution step-by-step, providing clarity for students and enthusiasts alike.

Foundational Concepts: Angles, Supplements, and Their Properties

Before tackling the problem at hand, it’s crucial to revisit some fundamental concepts in geometry, particularly concerning angles and their relationships.

What Is an Acute Angle?

- An acute angle is any angle that measures less than 90 degrees.
- Examples include angles measuring 30°, 45°, 60°, and so on.
- In this problem, the initial angle is specified as acute, so its measure is less than 90°.

Supplementary Angles: Definition and Properties

- Two angles are called supplementary if their measures add up to 180°.
- If angle A and angle B are supplementary, then:

$$A + B = 180°$$

- Supplementary angles can be adjacent (forming a linear pair) or non-adjacent, but the key property remains the same.

Applying These Concepts to the Problem

- The problem states: "If the supplement of an acute angle has a measure of (2x + 44)."
- Our goal: Find the measure of the original angle in terms of x.

Setting Up the Mathematical Relationship

To solve the problem, the first step is translating the given statement into an algebraic equation.

Identifying the Known and Unknown Quantities

- Let’s denote the acute angle as A.
- Its supplement, which measures $(2x + 44)$, is given.
- Since they are supplementary, the sum of the two angles equals 180°.

Expressing the Relationship

- The supplement of the angle A is $(2x + 44)$.
- Therefore, by the definition of supplementary angles:

$$
A + (2x + 44) = 180
$$

- Our task is to find A in terms of x.

Incorporating the 'Acute' Condition

- Since A is an acute angle, it must satisfy:

$$
0 < A < 90
$$

- This condition might be used later to check the validity of the solution.

Solving for the Angle in Terms of X

Having established the fundamental relationship, we now proceed to solve for A.

Step 1: Express A in terms of x

- From the equation:

$$
A + (2x + 44) = 180
$$

- Isolate A:

$$
A = 180 - (2x + 44)
$$

- Simplify:

$$
A = 180 - 2x - 44
$$

$$
A = (180 - 44) - 2x
$$

\[
A = 136 - 2x
\]

- Thus, the measure of the original angle \(A \) in terms of \(x \) is:

A = 136 - 2x

Step 2: Verify the 'Acute' Condition

- Since \(A \) is acute:

\[
0 < 136 - 2x < 90
\]

- Solve these inequalities separately to find the range of \(x \):

1. For the lower bound:

\[
136 - 2x > 0
\]
\[
-2x > -136
\]
\[
2x < 136
\]
\[
x < 68

\]

2. For the upper bound:

\[
136 - 2x < 90
\]
\[
-2x < -46
\]
\[
2x > 46
\]
\[
x > 23
\]

- Combining these:

\[
23 < x < 68
\]

- Therefore, for the original angle to be both valid and acute, \(x \) must lie in this interval.

Additional Insights and Contextual Understanding

While the core of the problem is straightforward algebra, understanding the context and implications provides deeper insight.

Why Is the 'Acute' Condition Important?

- It constrains the possible values of x, ensuring the resulting angle A is less than 90°.
- Without this constraint, the algebraic solution might yield values that do not correspond to an actual acute angle.

Physical and Practical Applications

- Such problems are common in geometry, trigonometry, and real-world scenarios like engineering, architecture, and design.
- For instance, when designing a structure with specific angular relationships, engineers need to calculate angles based on given constraints.

Extending the Problem

- The same approach can be used for various problems involving the relationships between angles, such as complementary angles (sum to 90°), vertical angles, or angles in polygons.
- Variations may involve algebraic expressions representing angles, requiring setting up and solving similar equations.

Summary and Key Takeaways

- The measure of the original acute angle A in terms of x is $136 - 2x$.
- The constraints for x to ensure A remains acute are $23 < x < 68$.
- The problem exemplifies how algebraic expressions and geometric definitions synergize to solve real-

world and theoretical problems.

- Understanding the fundamental properties of supplementary angles and inequalities is vital for accurate solutions.

Conclusion

The problem of finding an angle's measure based on the supplement's expression illustrates the elegance of combining geometric principles with algebraic techniques. Once translated into an equation, the solution becomes a matter of straightforward algebra, reinforced by the importance of understanding the properties of the angles involved. Whether for academic purposes or practical applications, mastering these relationships equips learners with essential tools for exploring the fascinating world of geometry.

Note: Always verify that your solutions satisfy the initial conditions of the problem, such as the angle being acute in this case, to ensure the validity of your results.

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