

Help PlzAn Angle Measures 4 Times Its Complement. What Is The Supplement Of The Smaller Angle?

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Understanding angles is fundamental in geometry, and solving problems involving various angle relationships can often pose a challenge. One such intriguing problem asks: "Help plz! An angle measures 4 times its complement. What is the supplement of the smaller angle?" This question involves several key concepts in geometry—complementary angles, supplementary angles, and algebraic solutions. In this comprehensive guide, we will explore the problem step-by-step, define all necessary terms, develop algebraic equations, and provide a clear path to the solution. Whether you're a student preparing for exams or someone interested in sharpening your geometry skills, this article will serve as an informative resource.

Understanding the Key Concepts: Complementary and Supplementary Angles

Before diving into the problem, it's essential to understand the fundamental concepts involved—complementary angles, supplementary angles, and how they relate to each other.

What Are Complementary Angles?

Complementary angles are two angles whose measures add up to 90 degrees. If two angles are complementary, then:

- Equation: $\text{Angle 1} + \text{Angle 2} = 90^\circ$
- Example: 30° and 60° , since $30 + 60 = 90$.

Complementary angles often appear in right-angled triangles and various geometric configurations.

What Are Supplementary Angles?

Supplementary angles are two angles whose measures sum to 180 degrees. If two angles are supplementary, then:

- Equation: $\text{Angle 1} + \text{Angle 2} = 180^\circ$
- Example: 110° and 70° , because $110 + 70 = 180$.

Supplementary angles commonly occur along straight lines, where they form a straight angle.

Relationship Between Complementary and Supplementary Angles

While complementary angles sum up to 90° , supplementary angles sum up to 180° . These concepts are crucial in solving geometric problems involving angle measures, especially when angles are related algebraically.

Problem Breakdown: An Angle and Its Complement

The problem states: "Help plz! An angle measures 4 times its complement." Let's define this more formally:

- Let's denote the smaller angle as x degrees.
- Its complement, therefore, is $90 - x$ degrees (since the sum of the two is 90°).

Given that the angle x is 4 times its complement:

Equation 1:
 $x = 4 (90 - x)$

Our goal is to find the measure of x , and then determine the supplement of the smaller angle.

Setting Up the Algebraic Equation

To solve for x , set up the algebraic equation based on the problem statement:

1. Express the complement of the angle as $(90 - x)$.
2. Translate the "measures 4 times" into an equation:

$$x = 4 (90 - x)$$

3. Expand the right side:

$$x = 4 \cdot 90 - 4x$$

$$x = 360 - 4x$$

4. Bring all variables to one side:

$$x + 4x = 360$$

$$5x = 360$$

5. Solve for x :

$$x = 360 / 5$$

$$x = 72$$

Thus, the smaller angle measures 72 degrees.

Verifying the Solution

Now, verify that the angle and its complement satisfy the problem's condition:

- Complement of 72° : $90 - 72 = 18^\circ$
- Check if 72° is 4 times its complement:

$$4 \cdot 18 = 72$$

Yes, the statement holds true, confirming our solution.

Finding the Supplement of the Smaller Angle

The problem asks: "What is the supplement of the smaller angle?" Since the smaller angle measures 72° , its supplement is:

- Supplement: $180 - \text{angle measure}$
- Calculation: $180 - 72 = 108^\circ$

Answer: The supplement of the smaller angle is 108 degrees.

Summary of the Solution Steps

To summarize the approach:

1. Define the angles: Let the smaller angle be x .
2. Write the complement: $90 - x$.
3. Set up the equation based on the problem statement: $x = 4(90 - x)$.
4. Solve for x : $x = 72^\circ$.
5. Verify the solution: Confirm that 4 times the complement equals the angle.
6. Calculate the supplement of the smaller angle: $180 - x = 108^\circ$.

Additional Tips for Solving Similar Geometry Problems

When tackling similar problems involving angles, consider these strategies:

- Identify what is given and what is asked: Clarify the relationships (complementary, supplementary, vertical, adjacent).
- Assign variables carefully: Use clear and consistent notation.
- Translate words into algebraic equations: This step is crucial for solving the problem systematically.
- Check your work: Verify whether the relationships hold with your solutions.
- Understand angle relationships: Remember key facts, such as the sum of supplementary angles being 180° , and that of complementary angles being 90° .

Real-World Applications of Angle Relationships

Understanding angles and their relationships is not only fundamental in geometry but also has practical applications in various fields:

- Architecture and Engineering: Designing structures with precise angles.
- Navigation: Calculating bearings and directions.
- Computer Graphics: Rendering scenes with accurate angles.
- Robotics: Programming joint movements based on angle calculations.

Recognizing these relationships enhances problem-solving skills and helps in practical scenarios.

Final Thoughts

In conclusion, solving the problem involving an angle that measures four times its complement and finding the supplement of the smaller angle involves a clear understanding of angle relationships and algebraic problem-solving. The key steps include defining variables, translating the problem into an equation, solving algebraically, and verifying the solution.

Recap of the key answer:

- The smaller angle measures 72° .
- Its complement is 18° .
- The supplement of the smaller angle is 108° .

By mastering these concepts, you can confidently approach various angle-related problems and enhance your overall understanding of geometry.

Keywords: angle measures, complement, supplement, geometry, algebra, problem-solving, angles relationships, supplementary angles, complementary angles, angle calculation, geometry problems, angle relationships in triangles.

Frequently Asked Questions

How do you find an angle that is four times its complement?

Let the smaller angle be x . Its complement is $90^\circ - x$. Since the angle is four times its complement: $x = 4(90^\circ - x)$. Solving this gives $x = 30^\circ$, and the complement is 60° .

What is the process to determine the supplement of the smaller angle in this problem?

First, find the smaller angle by setting up the equation based on the given ratio: $x = 4(90^\circ - x)$. Solve for x , then find its supplement by calculating $180^\circ - x$.

What is the value of the smaller angle if it measures four times its complement?

The smaller angle measures 30° , since solving the equation yields $x = 30^\circ$.

How do complementary and supplementary angles differ in this problem?

Complementary angles add up to 90° , while supplementary angles add up to 180° . This problem involves finding the smaller angle based on its relation to its complement, then determining its supplement.

What is the supplement of the smaller angle in the given problem?

The smaller angle is 30° , so its supplement is $180^\circ - 30^\circ = 150^\circ$.

Additional Resources

Help PlzAn Angle Measures 4 Times Its Complement. What Is The Supplement Of The Smaller Angle?

In the world of geometry, understanding the relationships between different types of angles—complementary, supplementary, and vertical angles—is fundamental. These relationships are not just theoretical; they form the backbone of numerous practical applications, from architecture to engineering, and even in computer graphics. A common challenge students face is translating word problems into algebraic expressions and solving for unknown angles. This article explores a classic problem: "An angle measures 4 times its complement. What is the supplement of the smaller angle?" Through a detailed breakdown, we aim to clarify the concepts involved and guide you step-by-step toward the solution.

Understanding the Key Concepts: Complementary and Supplementary Angles

Before diving into the problem, it's essential to review some fundamental definitions:

Complementary Angles

- Two angles are complementary if their measures add up to 90 degrees.
- Example: If one angle is 50° , the other must be 40° because $50^\circ + 40^\circ = 90^\circ$.
- Notation: If angle A and angle B are complementary, then $A + B = 90^\circ$.

Supplementary Angles

- Two angles are supplementary if their measures add up to 180 degrees.
- Example: If one angle is 110° , the other must be 70° because $110^\circ + 70^\circ = 180^\circ$.
- Notation: If angle C and angle D are supplementary, then $C + D = 180^\circ$.

Understanding these concepts is crucial because the problem involves relationships between an angle and its complement, as well as the supplementary angle of the smaller of the two angles.

Deciphering the Problem: Breaking Down the Statement

The problem states:

"Help PlzAn Angle Measures 4 Times Its Complement. What Is The Supplement Of The Smaller Angle?"

Let's parse this carefully:

- We are dealing with two angles: an angle, say x , and its complement.
 - The first part states: "An angle measures 4 times its complement." This indicates a relationship between x and its complement.
 - The second part asks: "What is the supplement of the smaller angle?"
- Meaning, after identifying the two angles, we need to find the supplementary angle of the smaller one.

To solve this, we need to:

1. Define variables for the angles.
2. Write algebraic expressions based on the relationships.
3. Solve for the angles.
4. Determine the smaller angle.
5. Find its supplement.

Step 1: Assign Variables and Write Equations

Let's start by defining the angles involved.

- Let x = the smaller angle.
- Since the problem involves the angle and its complement, we need to clarify which is which. It states: "An angle measures 4 times its complement." This suggests that x is the smaller angle, and its complement is the larger angle.

Important Note: The complement of an angle x is $90^\circ - x$.

Given that, the problem states:

- One angle (say x) measures 4 times its complement.

But which angle is 4 times its complement? It could be:

- The angle x is 4 times its complement.
- Or, its complement is 4 times the angle.

The phrasing "An angle measures 4 times its complement" suggests $x = 4$ (complement of x).

Thus, the relation:

$$x = 4 (90^\circ - x)$$

Step 2: Set Up the Equation and Solve for x

Using the relation:

$$x = 4(90^\circ - x)$$

Expand the right side:

$$x = 4 \cdot 90^\circ - 4x$$

Simplify:

$$x = 360^\circ - 4x$$

Bring all terms to one side:

$$x + 4x = 360^\circ$$

Combine like terms:

$$5x = 360^\circ$$

Divide both sides by 5:

$$x = 360^\circ / 5$$

$$x = 72^\circ$$

So, the smaller angle x measures 72° .

Step 3: Find the Complement of the Smaller Angle

Since $x = 72^\circ$, its complement C is:

$$C = 90^\circ - x = 90^\circ - 72^\circ = 18^\circ$$

Now, we verify the initial condition:

Is x equal to 4 times its complement?

$$- 4 \cdot 18^\circ = 72^\circ, \text{ which matches } x.$$

This confirms our calculations are consistent.

Step 4: Determine the Smaller and Larger Angles

From the calculations:

- The smaller angle $x = 72^\circ$
- Its complement $= 18^\circ$

Between these, the smaller angle is 18° (the complement), and the larger is 72° .

Step 5: Find the Supplement of the Smaller Angle

The problem asks: "What is the supplement of the smaller angle?"

Since the smaller angle is 18° , its supplement S is:

$$S = 180^\circ - 18^\circ = 162^\circ$$

Answer: The supplement of the smaller angle is 162° .

Additional Insights and Clarifications

This problem illustrates several key points:

- Clarity in language is essential: The phrase "an angle measures 4 times its complement" clearly indicates the relationship between the angle and its complement, which guides the algebraic setup.
- Complementary and supplementary angles are foundational concepts: Recognizing their definitions allows for quick calculations and problem-solving.
- Algebraic models are powerful: Assigning variables and translating word problems into equations simplifies complex relationships.

Common Mistakes to Avoid

- Confusing which angle is larger or smaller: Always verify your assumptions and double-check if the algebraic setup aligns with the problem statement.
- Misinterpreting the phrase "measures 4 times its complement": Clarify whether the angle is 4 times the complement or vice versa.
- Forgetting to verify the initial condition: After solving, substitute back to ensure the solution makes sense.

Practical Applications of Angle Relationships

Understanding how to manipulate and interpret these angles has real-world implications:

- Architectural design: Ensuring angles in structures are correct for stability.
- Navigation and surveying: Calculating precise angles for mapping.
- Computer graphics: Managing rotations and orientations.

Conclusion

In summary, the problem "Help PlzAn Angle Measures 4 Times Its Complement. What Is The Supplement Of The Smaller Angle?" exemplifies the importance of understanding basic geometric relationships and translating word problems into algebraic equations. By defining variables carefully, setting up correct equations, and performing systematic calculations, we found that the smaller angle is 18° , and its supplement is 162° . This approach not only solves the specific problem but also reinforces foundational skills applicable across various fields that rely on geometric reasoning.

Understanding these concepts equips students and professionals alike to confidently approach similar problems, ensuring accurate solutions and a

deeper appreciation for the elegant relationships within geometry.

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