

Find The Measure Of Each Angle In The Problem. 5) Complementary Angles With Measures $3x$ And $6x - 18$ Degrees

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Understanding how to find the measures of angles in various geometric problems is fundamental to mastering geometry. In particular, problems involving complementary angles are common and serve as excellent exercises for developing algebraic reasoning skills. This article guides you through the process of determining the measures of two complementary angles given their algebraic expressions, specifically angles with measures $3x$ and $6x - 18$ degrees. By exploring the concepts step-by-step, you will learn how to set up and solve similar problems confidently.

What Are Complementary Angles?

Before diving into the problem, it is essential to understand what complementary angles are.

Definition of Complementary Angles

Complementary angles are two angles whose measures add up to 90 degrees. This relationship holds regardless of the individual measures of the angles, provided they are less than 90 degrees each.

Key points:

- Sum of measures = 90°
- Each angle is called a complement of the other
- Can be adjacent (forming a right angle) or non-adjacent (not sharing a common side)

Examples of Complementary Angles

- 30° and 60°
- 45° and 45°
- 20° and 70°

In algebraic problems, the measures of the angles are often given as expressions involving variables, and the goal is to find the value of the variable that makes the sum 90° .

Understanding the Problem: Angles $3x$ and $6x - 18$ Degrees

In this specific problem, we are given two angles with measures expressed algebraically:

- First angle: $3x$ degrees
- Second angle: $6x - 18$ degrees

Since these are complementary angles, their measures must sum to 90 degrees. Our task is to find the value of x and then determine the measure of each angle.

Setting Up the Equation

Based on the definition of complementary angles:

$$(\text{Measure of first angle}) + (\text{Measure of second angle}) = 90^\circ$$

Substitute the given expressions:

$$3x + (6x - 18) = 90$$

Solving for x : Step-by-Step Process

Let's walk through the algebraic steps to find the value of x .

Step 1: Combine Like Terms

Add the expressions involving x :

$$3x + 6x - 18 = 90$$

This simplifies to:

$$(3x + 6x) - 18 = 90$$

$$9x - 18 = 90$$

Step 2: Isolate the Variable Term

Add 18 to both sides to move constants to the right:

$$9x - 18 + 18 = 90 + 18$$

$$9x = 108$$

Step 3: Solve for x

Divide both sides by 9:

$$x = 108 / 9$$

$$x = 12$$

Now that we have the value of x, we can find the measures of each angle.

Calculating the Measures of Each Angle

Using $x = 12$, substitute back into the expressions for the angles:

- First angle: $3x = 3 \cdot 12 = 36^\circ$
- Second angle: $6x - 18 = 6 \cdot 12 - 18 = 72 - 18 = 54^\circ$

Verification of the Solution

Add the two angles:

$$36^\circ + 54^\circ = 90^\circ$$

Since the sum is 90° , the angles are indeed complementary, confirming our solution.

Summary of the Findings

- The measure of the first angle ($3x$): 36 degrees
- The measure of the second angle ($6x - 18$): 54 degrees

These measures satisfy the condition of being complementary angles, and the algebraic process confirms the correctness of the solution.

Additional Tips for Solving Similar Problems

- Always recall the defining property of the angles involved (e.g., supplementary, complementary, vertical, etc.).
- Set up an algebraic equation based on that property.
- Combine like terms carefully before isolating the variable.
- Verify your solutions by substituting back into the original expressions.
- Use diagrams whenever possible to visualize the angles and their relationships.

Practice Problems to Reinforce Learning

Try solving these similar problems to improve your understanding:

1. Two angles are supplementary. One measures $2x + 10$ degrees, and the other measures $3x - 20$ degrees. Find the measures of both angles.
2. Angles $4x$ and $5x + 15$ are complementary. Determine the value of x and the measure of each angle.
3. In a right triangle, one acute angle measures $3x$ degrees, and the other measures $2x + 20$ degrees. Find the value of x and the measures of both angles.

Conclusion

Finding the measures of angles expressed algebraically involves understanding the relationships between angles, setting up appropriate equations, and solving for variables systematically. In the case of complementary angles given as $3x$ and $6x - 18$ degrees, the process includes:

- Recognizing the sum of the angles is 90°
- Setting up an algebraic equation
- Combining like terms
- Solving for the variable
- Calculating each angle's measure

Mastering this process enhances problem-solving skills and deepens understanding of geometric concepts. With practice, you'll be able to approach similar problems confidently and accurately, strengthening your overall grasp of geometry.

Remember: Always verify your solutions to ensure they satisfy the original conditions, and use diagrams to visualize the problem whenever possible.

Frequently Asked Questions

What are complementary angles?

Complementary angles are two angles whose measures add up to 90 degrees.

How do you set up an equation for the angles $3x$ and $6x - 18$ degrees?

Since the angles are complementary, their measures add up to 90 degrees: $3x + (6x - 18) = 90$.

What is the first step to find the value of x in this problem?

Combine like terms: $3x + 6x - 18 = 90$, which simplifies to $9x - 18 = 90$.

How do you solve for x in the equation $9x - 18 = 90$?

Add 18 to both sides: $9x = 108$. Then divide both sides by 9: $x = 12$.

What are the measures of the two angles when $x = 12$?

The first angle is $3x = 3 \cdot 12 = 36$ degrees, and the second angle is $6x - 18 = 6 \cdot 12 - 18 = 72 - 18 = 54$ degrees.

How can you verify that the angles are complementary?

Add the two angles: $36 + 54 = 90$ degrees, confirming they are complementary.

Additional Resources

Understanding Complementary Angles: Find the Measure of Each Angle in the Problem

When delving into the world of geometry, one of the foundational concepts students encounter is the idea of angles and their relationships. Among these, complementary angles hold particular importance due to their straightforward relationship: two angles are complementary if their measures sum to 90 degrees. This concept not only appears frequently in geometry problems but also forms the basis for understanding more complex angle relationships and proofs.

In this comprehensive review, we will explore a specific problem involving complementary angles with algebraic expressions: "Complementary angles with measures $3x$ and $6x - 18$ degrees." Our goal is to understand the problem thoroughly, break down the steps to find each angle's measure, and discuss related concepts to deepen your understanding of angles in geometry.

Introduction to Complementary Angles

Before tackling the problem, it's essential to grasp what complementary angles are and why they matter.

Definition of Complementary Angles

- Complementary angles are two angles whose measures add up to exactly 90 degrees.
- Mathematically, if angles are $\angle A$ and $\angle B$, then:

$$\angle A + \angle B = 90^\circ$$

- These angles can be adjacent (sharing a common side and vertex) or non-adjacent (not sharing a side but still summing to 90°).

Examples of Complementary Angles

- An angle measuring 30° and another measuring 60° .
- Two angles measuring 45° each.
- An angle of 70° and another of 20° .

Understanding that the sum must be 90° is key to solving problems involving complementary angles.

Analyzing the Problem: Complementary Angles with Measures $3x$ and $6x - 18$ Degrees

The problem provides two expressions:

- First angle: $3x$ degrees
- Second angle: $6x - 18$ degrees

Our task is to find the measures of each angle, which involves setting up an algebraic equation based on the property of complementary angles.

Step 1: Write the Equation Based on Complementary Angle Property

Since the angles are complementary:

$$3x + (6x - 18) = 90$$

This equation states that the sum of the two angles equals 90° .

Step 2: Simplify the Equation

Combine like terms:

$$3x + 6x - 18 = 90$$

$$(3x + 6x) - 18 = 90$$

$$9x - 18 = 90$$

Step 3: Solve for (x)

Add 18 to both sides:

$$9x = 90 + 18$$

$$9x = 108$$

Divide both sides by 9:

$$x = \frac{108}{9} = 12$$

This value of (x) will allow us to find each angle measure.

Calculating Each Angle's Measure

Now that we know $(x = 12)$, substitute back into each expression:

$$\text{- First angle: } (3x = 3 \times 12 = 36^\circ)$$

$$\text{- Second angle: } (6x - 18 = 6 \times 12 - 18 = 72 - 18 = 54^\circ)$$

Verification:

Sum the angles:

$$\backslash[$$

$$36^\circ + 54^\circ = 90^\circ$$

$$\backslash]$$

Since the sum is 90° , our solutions are consistent with the property of complementary angles.

Deep Dive into the Concepts and Methods

Understanding this problem in depth involves exploring various aspects:

Algebraic Representation of Angles

- Using algebra to represent angles is a powerful method, especially when angles are expressed in terms of a variable.
- It allows for solving unknown angles systematically, especially when dealing with geometric figures involving multiple angles.

Setting Up Equations Based on Angle Relationships

- Recognizing relationships like complementary, supplementary (sum to 180°), vertical, adjacent, or linear pairs is crucial.
- Once a relationship is identified, translating it into an algebraic equation is the next step.

Solving for the Variable

- Isolating the variable through inverse operations (addition/subtraction and multiplication/division) is standard.
- Careful simplification and checking your work ensures accuracy.

Substituting Back to Find Angles

- After solving for the variable, substitute back into the original expressions to find the actual measures.
- Always verify the results by checking if they satisfy the given conditions (e.g., sum to 90°).

Extending the Concept: Variations and Related Problems

While this problem is straightforward, similar problems can involve different angle relationships or additional constraints.

Problems with Different Sum Conditions

- Supplementary angles: Two angles summing to 180° , e.g., x and $(2x + 10)$ degrees where $x + 2x + 10 = 180$.
- Angles in polygons: Sum of interior angles, or angles in specific polygons.

Using Algebra in Other Angle Problems

- Finding angles in triangles using the fact that the interior angles sum to 180° .
- Solving for unknown angles in intersecting lines, where vertical angles are equal.
- Analyzing angles in parallel lines cut by a transversal, leading to alternate interior, corresponding, and consecutive interior angles.

Real-Life Applications

- Architectural design, where precise angle measurements are crucial.
- Engineering, where angle relationships determine the stability of structures.
- Navigation and surveying, involving angle calculations.

Common Mistakes to Avoid

Understanding where errors can occur helps in mastering the concept:

- Incorrect setup of the equation: Forgetting to add both angles or misidentifying the relationship.
- Arithmetic errors: Mistakes during addition, subtraction, multiplication, or division.
- Ignoring the constraints: Assuming angles are positive or within certain ranges without verification.
- Forgetting to verify the solution: Always check if the calculated angles satisfy the original property.

Summary and Key Takeaways

- Complementary angles are two angles that sum to 90° , and understanding this property allows for setting up algebraic equations to find unknown angles.
- Expressing angles algebraically, such as $(3x)$ and $(6x - 18)$, simplifies the process of solving for their measures.
- The step-by-step approach involves translating the problem into an equation, solving for the variable, and then substituting to find each angle.
- Verification confirms the correctness of the solution.
- Extending this understanding to related problems enhances overall geometric problem-solving skills.

Final Thoughts

Mastering the concept of complementary angles and applying algebraic methods to find unknown measures is fundamental for progressing in geometry. Problems like the one discussed serve as excellent practice for developing analytical skills, understanding relationships between angles, and applying algebra in geometric contexts. By internalizing these methods, students build a strong foundation that will support more advanced topics such as trigonometry, coordinate geometry, and proofs involving angles.

Remember, the key to success in geometry is not only memorizing formulas but also understanding the underlying relationships and developing systematic approaches to problem-solving. Keep practicing similar problems, pay attention to details, and verify your solutions to strengthen your mastery of geometric concepts.

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