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Understanding the ratios of the sides of a triangle is fundamental in geometry, as it helps determine the similarity of triangles, solve for unknown sides, and analyze geometric properties. In this article, we will explore the problem involving three given side lengths—35 cm, 42 cm, and 70 cm—and delve into how to find the ratio of these sides. We will cover the concepts step-by-step, ensuring clarity for students, educators, and math enthusiasts alike.

Introduction to Triangle Side Ratios

Before diving into the specific problem, it's essential to grasp the core concepts related to triangle sides and their ratios.

What Are Side Ratios?

A side ratio compares the lengths of two or more sides of a triangle. For example, if a triangle has sides of lengths 3 cm, 4 cm, and 5 cm, then the ratio of its sides can be expressed as 3:4:5.

Key points about side ratios:

- Ratios are simplified to their lowest terms.
- They help identify similar triangles: triangles with the same shape but different sizes have identical side ratios.
- Ratios are useful in real-world applications such as engineering, architecture, and design.

Why Are Ratios Important?

- They allow comparison between different triangles.
- They help in solving for unknown side lengths when some sides are known.
- They are essential in understanding proportionality and similarity in geometry.

Given Data and Problem Statement

The problem states:

> Helppp! Three sides of a triangle are 35 cm, 42 cm, and 70 cm. What is the ratio of the sides of the triangle?

At first glance, these lengths suggest the need to:

- Verify if these sides can form a triangle.
- Find the ratio of their lengths in simplest form.

Step 1: Verifying the Triangle Inequality

Before analyzing the ratios, it's critical to confirm whether the given lengths can form a valid triangle.

Triangle Inequality Theorem

The theorem states that for any triangle, the sum of the lengths of any two sides must be greater than the length of the remaining side.

Applying the theorem:

- $35\text{ cm} + 42\text{ cm} = 77\text{ cm} > 70\text{ cm} \rightarrow \text{Valid}$
- $35\text{ cm} + 70\text{ cm} = 105\text{ cm} > 42\text{ cm} \rightarrow \text{Valid}$
- $42\text{ cm} + 70\text{ cm} = 112\text{ cm} > 35\text{ cm} \rightarrow \text{Valid}$

Since all three conditions are satisfied, these lengths can indeed form a triangle.

Step 2: Expressing the Side Lengths as a Ratio

To find the ratio of the sides:

- List the side lengths: 35 cm, 42 cm, and 70 cm.

- Express these as a ratio: 35 : 42 : 70.

Step 3: Simplifying the Ratio

To simplify the ratio, find the greatest common divisor (GCD) of the side lengths.

Calculating GCD:

- GCD of 35, 42, and 70.

Prime factorization:

- $35 = 5 \times 7$
- $42 = 2 \times 3 \times 7$
- $70 = 2 \times 5 \times 7$

Common factors:

- All three have a common factor of 7.

Therefore, $\text{GCD} = 7$.

Dividing each side by 7:

- $35 \div 7 = 5$
- $42 \div 7 = 6$
- $70 \div 7 = 10$

Resulting ratio:

5 : 6 : 10

Step 4: Final Expression of the Ratio

The sides of the triangle are in the ratio:

5 : 6 : 10

This simplified ratio provides a clear proportional relationship between the sides.

Understanding the Significance of the Ratio 5:6:10

The ratio indicates the relative sizes of the sides. Notably, the largest side (70 cm) corresponds to the ratio component 10, which is double that of 5 and 6.

Implications:

- The side of length 70 cm is twice as long as the side with ratio 5 (which is 25 cm if scaled back).
- The sides 35 cm and 42 cm are proportional to 5 and 6 respectively.

Applications of Side Ratios in Geometry

Understanding side ratios is vital in various geometric problems.

Identifying Similar Triangles

- Triangles with proportional sides (like 5:6:10) are similar.
- Similar triangles have identical angles and proportional sides, which simplifies many geometric calculations.

Scaling and Model Creation

- Ratios help in creating scale models of objects.
- For example, architects use ratios to scale blueprints to real-world sizes.

Solving for Unknown Side Lengths

Suppose you know two sides are in ratio 5:6, and one side length is given, you can find the others.

Practical Example: Applying the Ratio

Problem:

Given that the sides are in ratio 5:6:10, and the side corresponding to 5 is 25 cm, find the remaining sides.

Solution:

- Scale factor = $25 \div 5 = 5$
- Second side: $6 \times 5 = 30$ cm
- Third side: $10 \times 5 = 50$ cm

Result:

The sides are 25 cm, 30 cm, and 50 cm.

Conclusion

In summary, the sides of the triangle with lengths 35 cm, 42 cm, and 70 cm are proportional to 5:6:10 after simplification. This ratio not only confirms the proportional relationships of the sides but also helps in understanding the properties of the triangle, such as similarity and scale modeling.

Key takeaways:

- Always verify if the given lengths can form a triangle using the triangle inequality theorem.
- Simplify ratios to their lowest terms to understand the fundamental proportional relationship.
- Use ratios to solve for unknowns, create models, and analyze geometric properties.

By mastering the concept of side ratios, students and enthusiasts can deepen their understanding of triangle properties, proportionality, and geometric similarity—tools essential for advanced studies and real-world applications.

Additional Resources and Practice Problems

To further strengthen your understanding, consider exploring these topics:

1. Practice problems:

- Find the ratio of sides for different triangles.

- Determine if two triangles are similar based on side ratios.
- Solve for missing side lengths given ratios and one side.

2. Interactive tools:

- Geometry calculators online that can assist in ratio simplification.
- Dynamic geometry software (like GeoGebra) for visualizing triangles and their proportions.

3. Further reading:

- "Basic Geometry" by David A. Brannan.
- Online tutorials on triangle similarity and proportional reasoning.

Remember: Understanding ratios is key to unlocking many geometric concepts. Keep practicing, and you'll master the art of proportional reasoning in no time!

Frequently Asked Questions

What is the ratio of the sides of the triangle with lengths 35 cm, 42 cm, and 70 cm?

The ratio of the sides is 35 : 42 : 70. Simplifying by dividing each term by 7, the ratio becomes 5 : 6 : 10.

Are the given sides 35 cm, 42 cm, and 70 cm forming a valid triangle?

Yes, because the sum of any two sides is greater than the third: $35 + 42 = 77 > 70$, $35 + 70 = 105 > 42$, and $42 + 70 = 112 > 35$, so they form a valid triangle.

How can I simplify the ratio of the sides 35, 42, and 70?

Divide each side by their greatest common divisor, which is 7: $35 \div 7 = 5$, $42 \div 7 = 6$, $70 \div 7 = 10$. So, the simplified ratio is 5:6:10.

What type of triangle is formed by sides 35 cm, 42 cm, and 70 cm?

Since 70 is the largest side, check if Pythagoras theorem applies: $35^2 + 42^2 = 1225 + 1764 = 2989$, which is less than $70^2 = 4900$, so the triangle is

scalene and obtuse.

Can these sides form a right-angled triangle?

No, because the Pythagoras theorem does not hold: $35^2 + 42^2 \neq 70^2$, so the triangle is not right-angled.

What is the importance of knowing the ratio of sides in a triangle?

Knowing the ratio helps in understanding the relative proportions of the sides, which is useful in similarity, scaling, and solving geometric problems related to the triangle.

Additional Resources

Helppp! Three sides of a triangle are 35 cm, 42 cm, and 70 cm. What is the ratio of the sides of the triangle?

Understanding the ratio of sides in a triangle is fundamental in geometry, especially when analyzing the proportional relationships between different triangles or solving problems involving similar figures. In this guide, we will explore how to determine the ratio of the sides of a triangle given specific lengths, using the example where the sides measure 35 cm, 42 cm, and 70 cm. This comprehensive breakdown will help you master the process of simplifying ratios, verifying triangle validity, and understanding the implications of side ratios in geometric contexts.

Understanding the Problem

Before diving into calculations, let's clarify the problem:

- Given sides: 35 cm, 42 cm, and 70 cm.
- Objective: Find the ratio of the sides of this triangle.

This task involves simplifying the ratios of the side lengths to their lowest terms, which can reveal whether the triangle corresponds to a common scaled version of a simpler triangle, or if the ratios suggest particular properties, such as whether the triangle is right-angled or isosceles.

Step 1: Verify the Validity of the Triangle

Before analyzing the ratios, ensure that the given lengths can indeed form a triangle. The Triangle Inequality Theorem states that:

- The sum of any two sides must be greater than the third.

Let's verify:

1. $35 + 42 = 77 > 70$ ✓□
2. $35 + 70 = 105 > 42$ ✓□
3. $42 + 70 = 112 > 35$ ✓□

Since all conditions are satisfied, the given lengths can form a valid triangle.

Step 2: Find the Ratio of the Sides

The ratio of the sides is simply the comparison of their lengths in the simplest form. To do this:

2.1 List the side lengths:

- Side A = 35 cm
- Side B = 42 cm
- Side C = 70 cm

2.2 Express the ratios as fractions:

- 35 : 42 : 70

2.3 Simplify each ratio to their lowest terms:

To simplify, find the greatest common divisor (GCD) for all three numbers or simplify pairwise.

Step 3: Simplify the Ratios

3.1 Find the GCD of 35, 42, and 70

Prime factorization:

- $35 = 5 \times 7$
- $42 = 2 \times 3 \times 7$
- $70 = 2 \times 5 \times 7$

Common prime factors among all three:

- 7

Thus, $\text{GCD} = 7$.

3.2 Divide each side by 7:

- $35 \div 7 = 5$
- $42 \div 7 = 6$
- $70 \div 7 = 10$

3.3 Write the simplified ratio:

5 : 6 : 10

Step 4: Expressing the Ratio

The simplified ratio of the sides of the triangle is 5:6:10.

This ratio indicates the proportional relationship between the sides, which can be useful for:

- Determining if the triangle has special properties (e.g., right-angled, isosceles)
- Comparing with other triangles
- Solving problems involving similar triangles

Step 5: Analyzing the Triangle Based on Side Ratios

5.1 Is the triangle right-angled?

To check if the triangle is a right triangle, use the Pythagorean theorem:

- The square of the longest side should be equal to the sum of the squares of the other two sides.

Longest side: 70 cm (or 10 in the simplified ratio).

Check:

- $70^2 = 4900$
- $35^2 + 42^2 = 1225 + 1764 = 2989$

Since $4900 \neq 2989$, the triangle is not a right triangle.

5.2 Is the triangle scalene, isosceles, or equilateral?

- All sides are different lengths.
- Therefore, the triangle is scalene.

Step 6: Practical Applications of the Ratio

Understanding the ratio of sides helps in various geometric and real-world problems:

- Scaling figures: If a triangle has sides in the ratio 5:6:10, any similar triangle will maintain these proportions.
- Construction and design: Knowing ratios ensures accurate scaling in models or structures.
- Problem-solving: Ratios assist in calculating unknown lengths or angles in similar triangles.

Summary of Key Points

- The given sides (35 cm, 42 cm, 70 cm) satisfy the triangle inequality theorem.
- The ratio of the sides simplifies to 5:6:10.
- The triangle is scalene and not right-angled.
- Simplified ratios reveal proportional relationships critical for understanding similar figures or scaling.

Final Thoughts

Determining the ratio of the sides of a triangle is a fundamental skill in geometry, providing insights into the shape's properties and relationships. In this example, simplifying the ratios from 35:42:70 to 5:6:10 offers a clear view of the proportional relationships, which can be applied in various mathematical and real-world contexts. Whether you're tackling geometry homework, designing a structure, or analyzing similar triangles, mastering the process of ratio simplification and interpretation is an invaluable tool in your mathematical toolkit.

Remember: Always verify the triangle's validity before analyzing its ratios, and look for opportunities to simplify ratios to their lowest terms for clearer insights.

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