

Triangle ABC Is Congruent To Triangle DEF, $DE = 8\text{cm}$ $EF = 7\text{cm}$ Angle B = 75 Degree Find BC And Angle E

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Understanding the Problem: Congruent Triangles and Given Data

When dealing with geometric problems involving congruent triangles, it is essential to understand what congruence implies and how to utilize the given data effectively. In this scenario, we are told that Triangle ABC is congruent to Triangle DEF, with specific side lengths and an angle measure provided. The goal is to find the length of BC and the measure of Angle E.

Given Data:

- $DE = 8\text{ cm}$
- $EF = 7\text{ cm}$
- Angle B = 75°

From the statement, the key points are:

- The triangles are congruent: $ABC \cong DEF$
- Sides DE and EF have lengths 8 cm and 7 cm, respectively
- Angle B in triangle ABC measures 75°

Understanding Triangle Congruence and Its Implications

What Does Congruence Mean?

Two triangles are congruent if their corresponding sides and angles are exactly equal. This is denoted as $\cong$.

Types of Triangle Congruence Criteria

- SSS (Side-Side-Side): All three corresponding sides are equal.
- SAS (Side-Angle-Side): Two sides and the included angle are equal.
- ASA (Angle-Side-Angle): Two angles and the included side are equal.
- AAS (Angle-Angle-Side): Two angles and a non-included side are equal.
- HL (Hypotenuse-Leg): For right triangles only.

Given the information, we need to identify which criteria apply and how to relate the data from the two triangles.

Relating the Given Data to the Congruence

Corresponding Sides and Angles

Since Triangle ABC $\cong$ Triangle DEF, their corresponding parts are equal:

Triangle ABC Triangle DEF
----- -----
Side AB Side DE 8 cm (given)
Side BC Side EF ?
Side AC Side FD ?
Angle A Angle D ?
Angle B Angle E given as 75°
Angle C Angle F ?

The key is to identify which vertices correspond to which and then use the given data to find the unknowns.

Step-by-Step Solution Approach

1. Establish Correspondence Between Triangles

Since $DE = 8\text{ cm}$ and $EF = 7\text{ cm}$, and the triangles are congruent, we can assume:

- $AB \leftrightarrow DE$
- $BC \leftrightarrow EF$
- $AC \leftrightarrow FD$

and similarly for angles:

- $A \leftrightarrow D$
- $B \leftrightarrow E$
- $C \leftrightarrow F$

Given $\text{Angle } B = 75^\circ$, it corresponds to $\text{Angle } E$ in triangle DEF.

2. Find BC (Corresponds to EF)

From the congruence, the side BC in triangle ABC corresponds to EF in triangle DEF, which is 7 cm.

3. Find Angle E

Since B in triangle ABC corresponds to E in triangle DEF, and $\text{Angle } B = 75^\circ$, then:

$\text{Angle } E = 75^\circ$

Calculating Missing Values: BC and Angle E

Confirming $BC = 7\text{ cm}$

Based on the correspondence, BC equals EF, which is 7 cm. Therefore:

$BC = 7\text{ cm}$

Confirming Angle E

Since $\text{Angle } B = 75^\circ$ and corresponds to Angle E, it follows:

$\text{Angle } E = 75^\circ$

Additional Calculations and Considerations

While the direct correspondence simplifies the problem, it's important to understand the geometric reasoning, especially if the problem involves more complex configurations or additional data.

When Additional Data Is Provided

In more complex problems, you might need to:

- Use the Law of Sines or Law of Cosines to find unknown side lengths or angles.
- Employ triangle properties such as the sum of angles (180°).
- Use the given side lengths and angles to verify the triangle's similarity or congruence.

Using the Law of Cosines to Verify or Find Sides

Suppose you need to find BC if more data is provided, or to verify if the triangle is right-angled, Law of Cosines and Law of Sines are instrumental.

Law of Cosines:

$$c^2 = a^2 + b^2 - 2ab \cos C$$

Where:

- (a, b, c) are sides
- (C) is the angle opposite side (c)

In our case, if the triangle is not right-angled and the angles are unknown, this law helps in calculating unknown sides.

Conclusion: Final Values for BC and Angle E

Based on the provided congruence and data:

- $BC = 7 \text{ cm}$
- $\text{Angle } E = 75^\circ$

This problem illustrates the importance of understanding triangle congruence, correspondence of sides and angles, and how to apply known geometric principles to find unknown measures.

Additional Tips for Solving Similar Triangle Problems

- Always establish clear correspondence between the vertices of the congruent triangles.
- Use given data to identify which sides and angles are equal.
- Recall that in congruent triangles, all corresponding parts are equal.
- When uncertain, sketch the triangles and label all known and unknown parts.
- Use relevant laws (Law of Sines, Law of Cosines) for non-trivial problems involving unknown sides or angles.

Summary

In summary, given that Triangle ABC is congruent to Triangle DEF, with sides $DE = 8 \text{ cm}$, $EF = 7 \text{ cm}$, and $\text{Angle } B = 75^\circ$, the following can be concluded:

- Side BC corresponds to EF, so $BC = 7 \text{ cm}$
- Angle E corresponds to Angle B, so $\text{Angle } E = 75^\circ$

Understanding the relationship between congruent triangles helps solve for unknown sides and angles efficiently, making these principles fundamental in geometry problem-solving.

Remember: Properly identifying corresponding parts and applying the properties of congruence are key to solving triangle problems effectively.

Frequently Asked Questions

Given that triangles ABC and DEF are congruent with $DE = 8\text{cm}$, $EF = 7\text{cm}$, and angle $B = 75^\circ$, how can we determine the length of BC?

Since the triangles are congruent, corresponding sides are equal. If BC corresponds to EF, then $BC = EF = 7\text{cm}$.

In triangle ABC congruent to DEF, with $DE = 8\text{cm}$, $EF = 7\text{cm}$, and angle $B = 75^\circ$, what is the measure of angle E?

Because the triangles are congruent, corresponding angles are equal. If angle B corresponds to angle E, then angle $E = 75^\circ$.

How does knowing that triangles ABC and DEF are congruent help in finding the side BC and angle E?

Congruence ensures that all corresponding sides and angles are equal, so BC equals the length of the side corresponding to EF, and angle E equals angle B, simplifying the problem.

If triangle ABC is congruent to triangle DEF with given sides and angle, can we determine the length of BC directly? If so, how?

Yes. Since BC corresponds to EF, and EF is given as 7cm , then $BC = 7\text{cm}$ directly from the congruence.

Given the data, what additional information is needed to find the length of BC and the measure of angle E if they are not directly corresponding to known sides and angles?

You would need to know the specific correspondence of sides and angles between the two triangles or additional measurements, such as another side length or angle, to determine BC and angle E accurately.

Additional Resources

Triangle ABC Is Congruent To Triangle DEF, $DE = 8\text{cm}$ $EF = 7\text{cm}$ Angle $B = 75^\circ$ Find BC And Angle E

Understanding and solving geometric problems involving congruency and measurements can be both challenging and rewarding. In this detailed analysis, we will explore the problem of determining the length of side BC and the measure of angle E in two congruent triangles, ABC and DEF, given specific data points. This problem combines the principles of triangle congruency, properties of angles and sides, and the application of the Law of Cosines and Law of Sines. Our goal is to methodically analyze the problem,

identify the relevant concepts, and derive the required measurements with clarity.

Understanding the Problem Statement

The problem states:

- Triangle ABC is congruent to triangle DEF.
- $DE = 8\text{ cm}$
- $EF = 7\text{ cm}$
- $\text{Angle B} = 75^\circ$
- Find BC and angle E.

At first glance, the problem offers partial information about the triangles and asks for unknown measurements. The key points to note include:

- The congruency of the triangles indicates that corresponding sides and angles are equal.
- The given sides (DE and EF) are parts of triangle DEF.
- Angle B is given as 75° , which belongs to triangle ABC.

The challenge is to connect these pieces of information to find the unknown side BC and angle E.

Analyzing Triangle Congruency

What Does Congruent Mean?

Two triangles are congruent if they have exactly the same size and shape, meaning their corresponding sides and angles are equal. The common congruency criteria are:

- SSS (Side-Side-Side): All three sides are equal.
- SAS (Side-Angle-Side): Two sides and the included angle are equal.
- ASA (Angle-Side-Angle): Two angles and the included side are equal.
- RHS (Right angle-Hypotenuse-Side): For right triangles.

Given that triangles ABC and DEF are congruent, the correspondence of their vertices and sides must be

clearly established.

Implication of Congruency for the Given Data

- Since $DE = 8$ cm, then the side corresponding to DE in triangle ABC (say, AB or AC) must also be 8 cm.
- $EF = 7$ cm similarly corresponds to another side in triangle ABC .

However, the problem does not explicitly specify which sides DE and EF correspond to in ABC , nor the angles directly. The congruency assumption suggests a correspondence like:

- $D \leftrightarrow A$
- $E \leftrightarrow B$
- $F \leftrightarrow C$

or some other matching, but the problem needs clarification.

Assuming the standard correspondence:

- $D \leftrightarrow A$
- $E \leftrightarrow B$
- $F \leftrightarrow C$

then:

- DE (8 cm) corresponds to AB
- EF (7 cm) corresponds to BC
- FC corresponds to AC

Similarly, angles at vertices B and E are corresponding angles in the congruent triangles.

Applying the Given Data to Find BC

Step 1: Establishing Correspondence

Given the problem's data, and assuming the standard correspondence:

- Triangle ABC $\leftrightarrow$ Triangle DEF
- AB $\leftrightarrow$ DE
- BC $\leftrightarrow$ EF
- AC $\leftrightarrow$ FD

From the data:

- DE = 8 cm $\leftrightarrow$ AB
- EF = 7 cm $\leftrightarrow$ BC

Since EF corresponds to BC, then BC = 7 cm.

Thus, the length of side BC is 7 cm.

Step 2: Confirming the Correspondence and Additional Information

- We know angle B = 75° , which is at vertex B in triangle ABC.
- Since triangles are congruent, angle B in ABC corresponds to angle E in DEF.
- To find angle E, we need to understand the angles in the triangles.

Finding Angle E

Step 1: Relationship between Angles and Congruency

- Because of the congruency, and assuming the correspondence:
- B in ABC corresponds to E in DEF.
- Therefore, angle E in triangle DEF equals angle B in ABC, which is 75° .

Hence, angle E = 75° .

Summary of Findings

Parameter	Value	Explanation
BC	7 cm	Corresponds to EF in the congruent triangle.
Angle E	75°	Corresponds to angle B in ABC due to congruency.

Additional Considerations and Clarifications

While the above reasoning assumes a direct correspondence based on standard congruency principles, real-world problems often require verifying assumptions, especially when the problem statement is ambiguous.

Pros of the Provided Data:

- The problem provides concrete measurements, enabling precise calculation.
- The assumption of congruency simplifies the problem, linking sides and angles directly.

Cons and Limitations:

- Lack of explicit correspondence mapping makes assumptions necessary.
- The problem does not specify which sides correspond to DE and EF explicitly.
- Missing information about other sides or angles could complicate more advanced calculations or verifications.

Features of the Approach:

- Applying the principle of congruency to directly identify unknown sides and angles.
 - Using logical assumptions based on standard conventions.
-

Potential Extensions and Additional Calculations

If further information were provided, such as the length of other sides or angles, more detailed calculations could be performed, including:

- Using Law of Cosines to verify side lengths if angles are known.
- Calculating other angles in the triangles if additional data is given.
- Exploring the triangle's area or other properties.

Conclusion

In this comprehensive review, we have analyzed the problem of congruency between triangles ABC and DEF, where given sides and an angle allow us to determine the length of side BC and angle E. Based on the assumptions of standard correspondence and congruency principles:

- The length of side BC is 7 cm.
- The measure of angle E is 75° .

This problem illustrates the importance of understanding triangle congruency criteria, the significance of proper correspondence between sides and angles, and the utility of basic trigonometric principles in solving geometric problems. When approaching similar problems, clarity about correspondence and explicit data are vital for accurate solutions.

Final notes: When tackling real-world geometry problems, always double-check the correspondence assumptions and look for additional data to confirm your solutions. The combination of logical reasoning and fundamental geometric theorems forms the backbone of effective problem-solving in this domain.

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