

NCERT Solutions Class 9 Maths

Chapter 7: Triangles

EXERCISE 7.1

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Quick Summary: In NCERT Solutions Class 9 Maths Chapter 7 Exercise 7.1, students learn the fundamental concepts of congruent triangles through step-by-step proofs and applications. This exercise covers all four congruence rules (SSS, SAS, ASA, RHS) with detailed solutions that help students understand geometric reasoning and proof techniques essential for CBSE Class 9 board exams and competitive examinations.

Key Takeaways:

- Master the four congruence criteria: SSS (Side-Side-Side), SAS (Side-Angle-Side), ASA (Angle-Side-Angle), and RHS (Right angle-Hypotenuse-Side)
- Learn to write geometric proofs using congruent triangles, including statements like $\triangle ABC \cong \triangle DEF$
- Understand properties of angle bisectors and perpendiculars through triangle congruence applications
- Develop logical reasoning skills for solving complex geometry problems that frequently appear in CBSE exams

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Question 1

QUESTION

In quadrilateral ACBD, $AC = AD$ and AB bisects $\angle A$ (see Fig. 7.16). Show that $\triangle ABC \cong \triangle ABD$. What can you say about BC and BD?

SOLUTION

This question tests the concept of congruent triangles, specifically the Side-Angle-Side (SAS) congruence rule. We need to prove that $\triangle ABC$ and $\triangle ABD$ are congruent and then deduce the relationship between BC and BD.

Step 1: Identify the given information

We are given that:

- $AC = AD$
- AB bisects $\angle A$, which means

Step 2: Analyze the triangles and

Consider $\triangle ABC$ and $\triangle ABD$. We have:

- $AC = AD$ (Given)
- $\angle CAB = \angle DAB$ (Since AB bisects $\angle A$)
- $AB = AB$ (Common side)

Step 3: Apply the SAS congruence rule

By the Side-Angle-Side (SAS) congruence rule, if two sides and the included angle of one triangle are equal to the corresponding two sides and the included angle of another triangle, then the two triangles are congruent.

In our case, we have:

- Side $AC =$ Side AD
- Angle $\angle CAB =$ Angle $\angle DAB$
- Side $AB =$ Side AB

Therefore, by SAS congruence,

Step 4: Deduce the relationship between BC and BD using CPCT

Since $\triangle ABC \cong \triangle ABD$, their corresponding parts must be equal. This is known as the CPCT (Corresponding Parts of Congruent Triangles) rule.

Therefore, $BC = BD$ (corresponding sides of congruent triangles).

Final Answer: They are equal.

ANSWER

They are equal.

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Question 2

QUESTION

ABCD is a quadrilateral in which $AD = BC$ and $\angle DAB = \angle CBA$ (see Fig. 7.17). Prove that:

- (i) $\triangle ABD \cong \triangle BAC$
- (ii) $BD = AC$
- (iii) $\angle ABD = \angle BAC$

SOLUTION

This question tests our understanding of triangle congruence, specifically the Side-Angle-Side (SAS) congruence rule. We need to prove the given statements by showing that the triangles ABD and BAC are congruent.

(i) Proving

Step 1: Identify the given information

We are given that:

$$AD = BC$$

Step 2: Identify the common side

Observe that side AB is common to both triangles and .

Therefore, $AB = BA$ (Common side)

Step 3: Apply the SAS congruence rule

We have:

$$AD = BC \text{ (Given)}$$

(Given)

$$AB = BA \text{ (Common side)}$$

By the SAS congruence rule, if two sides and the included angle of one triangle are equal to the corresponding two sides and the included angle of another triangle, then the two triangles are congruent.

Therefore,

(ii) Proving $BD = AC$

Step 1: Use the result from part (i)

Since we have already proven that , we can use the property of congruent triangles that corresponding parts of congruent triangles are equal (CPCT).

Step 2: Apply CPCT

BD and AC are corresponding sides of the congruent triangles and respectively.

Therefore, by CPCT, $BD = AC$

(iii) Proving

Step 1: Use the result from part (i) again

Again, since , we can use the CPCT property.

Step 2: Apply CPCT

and are corresponding angles of the congruent triangles and respectively.

Therefore, by CPCT,

ANSWER

(i) $\triangle ABD \cong \triangle BAC$

(ii) $BD = AC$

(iii) $\angle ABD = \angle BAC$

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Question 3

QUESTION

AD and BC are equal perpendiculars to a line segment AB (see Fig. 7.18). Show that CD bisects AB.

SOLUTION

This question tests our understanding of congruent triangles and the properties of perpendiculars. We need to prove that CD bisects AB, meaning that the point of intersection, let's call it O, is the midpoint of AB ($AO = BO$).

Step 1: Draw the Diagram and Mark Given Information

We are given that AD and BC are equal perpendiculars to AB. This means and .

Step 2: Identify Triangles to Prove Congruent

Consider triangles and . We want to prove these triangles congruent.

Step 3: Prove Triangle Congruence

In and :

(Vertically opposite angles)

(Given)

(Given)

Therefore, by the Angle-Angle-Side (AAS) congruence rule.

Step 4: Use CPCT (Corresponding Parts of Congruent Triangles)

Since , by CPCT, we have:

Step 5: Conclude that CD bisects AB

Since , point O is the midpoint of AB. Since O is the point where CD intersects AB, CD bisects AB.

Therefore, CD bisects AB, i.e. O is the midpoint of AB.

ANSWER

CD bisects AB, i.e. D is the midpoint of AB.

Question 4

QUESTION

Lines l and m are two parallel lines intersected by another pair of parallel lines p and q (see Fig. 7.19). Show that $\triangle ABC \cong \triangle CDA$.

SOLUTION

This question asks us to prove that two triangles, $\triangle ABC$ and $\triangle CDA$, are congruent given that lines l and m are parallel and lines p and q are parallel. This tests our understanding of parallel lines, transversals, and congruence rules for triangles.

Step 1: Identify the given information

We are given that $l \parallel m$ and $p \parallel q$. This means that opposite sides of quadrilateral $ABCD$ are parallel, making it a parallelogram.

Step 2: Identify equal angles

Since $l \parallel m$, line p is a transversal. Therefore, alternate interior angles are equal:

(Alternate interior angles)

Similarly, since $l \parallel m$, line q is a transversal. Therefore, alternate interior angles are equal:

(Alternate interior angles)

Step 3: Identify the common side

Side AC is common to both triangles $\triangle ABC$ and $\triangle CDA$.

(Common side)

Step 4: Apply the ASA congruence rule

We have:

Therefore, by the Angle-Side-Angle (ASA) congruence rule:

Final Answer:

Conclusion: By identifying the equal angles formed by the parallel lines and the common side, we were able to apply the ASA congruence rule to prove that the two triangles are congruent. This method works because the properties of parallel lines guarantee the equality of alternate interior angles, which, combined with a common side, satisfy the conditions for ASA congruence.

ANSWER

$\triangle ABC \cong \triangle CDA$

Question 5

QUESTION

Line l is the bisector of an angle $\angle A$ and B is any point on l . BP and BQ are perpendiculars from B to the arms of $\angle A$ (see Fig. 7.20). Show that:

- (i) $\triangle APB \cong \triangle AQB$
- (ii) $BP = BQ$ or B is equidistant from the arms of $\angle A$.

SOLUTION

This question tests our understanding of congruent triangles, particularly the Angle-Side-Angle (ASA) congruence rule and the properties of angle bisectors.

(i) Proving

Step 1: Identify the given information

We are given that line l is the angle bisector of $\angle A$. This means $\angle PAB = \angle QAB$.

We are also given that BP and BQ are perpendiculars from B to the arms of $\angle A$. This means $\angle APB = \angle AQB = 90^\circ$.

Step 2: State the angles and side to be used for ASA congruence

In $\triangle APB$ and $\triangle AQB$:

$\angle PAB = \angle QAB$ (Since l is the angle bisector of $\angle A$)

$\angle APB = \angle AQB$ (Given)

$AB = AB$ (Common side)

Step 3: Apply ASA congruence rule

By the Angle-Side-Angle (ASA) congruence rule, if two angles and the included side of one triangle are equal to the corresponding two angles and the included side of another triangle, then the two triangles are congruent.

Therefore, $\triangle APB \cong \triangle AQB$.

(ii) Proving $BP = BQ$

Step 1: Use the result from part (i)

Since $\triangle APB \cong \triangle AQB$, their corresponding parts are equal (CPCT - Corresponding Parts of Congruent Triangles).

Step 2: State the corresponding parts

BP and BQ are corresponding sides of the congruent triangles and $BP = BQ$.

Step 3: Conclude

Therefore, $BP = BQ$ (By CPCT).

Since $BP = BQ$, B is equidistant from the arms of .

ANSWER

(i) $\triangle APB \cong \triangle AQB$

(ii) $BP = BQ$ (B is equidistant from the arms of $\angle A$).

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Question 6

QUESTION

In Fig. 7.21, $AC = AE$, $AB = AD$ and $\angle BAD = \angle EAC$. Show that $BC = DE$.

SOLUTION

This question tests our understanding of congruent triangles, specifically the SAS (Side-Angle-Side) congruence rule. We need to prove that $BC = DE$, which means we need to show that triangles ABC and ADE are congruent.

Step 1: Analyze the given information

We are given:

Step 2: Manipulate the given angles

We want to relate $\angle BAC$ and $\angle DAE$. Notice that both $\angle BAC$ and $\angle DAE$ are "missing" the angle $\angle CAD$.

Add $\angle CAD$ to both sides of the equation :

Step 3: Simplify the angles

Observe that:

Therefore, we have:

Step 4: Prove triangle congruence

Now we have:

(Given)

(Proved above)

(Given)

By the SAS congruence rule, $\triangle ABC \cong \triangle ADE$.

Step 5: Conclude that $BC = DE$

Since $\triangle ABC \cong \triangle ADE$, their corresponding parts are equal (CPCT - Corresponding Parts of Congruent Triangles).

Therefore, $BC = DE$.

ANSWER

$\angle BAC = \angle DAE$

Question 7

QUESTION

AB is a line segment and P is its mid-point. D and E are points on the same side of AB such that $\angle BAD = \angle ABE$ and $\angle EPA = \angle DPB$ (see Fig. 7.22). Show that:

- (i) $\triangle DAP \cong \triangle EBP$
- (ii) $AD = BE$.

SOLUTION

This question tests our understanding of triangle congruence, specifically using the ASA (Angle-Side-Angle) congruence rule. We need to prove that two triangles are congruent and then use the CPCT (Corresponding Parts of Congruent Triangles) property to show that two line segments are equal.

(i) Proving

Step 1: Identify the given information

We are given that P is the midpoint of AB, which means:

We are also given that:

Step 2: Manipulate the given angles to find a common angle

We have . Add to both sides:

This simplifies to:

Step 3: Use the ASA congruence rule

Now we have:

(Proved above)

(Given, P is the midpoint)

(Same as)

Therefore, by the ASA congruence rule:

(ii) Proving $AD = BE$

Step 1: Use CPCT

Since we have already proved that , we can use the CPCT (Corresponding Parts of Congruent Triangles) property.

Step 2: Identify corresponding sides

AD is a side of and BE is a side of .

Since the triangles are congruent, their corresponding sides must be equal.

Step 3: Conclude

Therefore, by CPCT:

ANSWER

(i) $\triangle DAP \cong \triangle EBP$

(ii) $AD = BE$

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Question 8

QUESTION

In right triangle ABC, right angled at C, M is the mid-point of hypotenuse AB. C is joined to M and produced to a point D such that $DM = CM$. D is joined to B (see Fig. 7.23). Show that:

- (i) $\triangle AMC \cong \triangle BMD$
- (ii) $\angle DBC$ is a right angle.
- (iii) $\triangle DBC \cong \triangle ACB$
- (iv) $CM = \frac{1}{2} AB$.

SOLUTION

This question involves proving congruence of triangles and deducing properties related to right triangles and midpoints. We will use congruence rules (SAS, ASA, SSS) and properties of angles to prove the given statements.

(i) Proving

Step 1: Identify given information

We are given that M is the midpoint of AB, so $AM = MB$. Also, $DM = CM$.

Step 2: Identify angles

$\angle AMC = \angle BMD$ because they are vertically opposite angles.

Step 3: Apply SAS congruence rule

In $\triangle AMC$ and $\triangle BMD$:

$AM = MB$ (M is midpoint)

$\angle AMC = \angle BMD$ (Vertically opposite angles)

$CM = DM$ (Given)

Therefore, by the SAS congruence rule, $\triangle AMC \cong \triangle BMD$.

(ii) Proving $\angle DBC$ is a right angle

Step 1: Use congruence from part (i)

Since $\triangle AMC \cong \triangle BMD$, corresponding parts of congruent triangles are equal. Therefore, $\angle A = \angle B$.

Step 2: Identify angles and parallel lines

$\angle A = \angle B$ and $\angle C = 90^\circ$ are alternate interior angles. Since they are equal, $AC \parallel BD$.

Step 3: Use properties of parallel lines and transversals

Since $AC \parallel BD$ and BC is a transversal, (co-interior angles), $\angle C + \angle DBC = 180^\circ$.

We know (given).

Therefore, , which implies .

(iii) Proving

Step 1: Identify known information

We know (by CPCT of).

We also know .

And (common side).

Step 2: Apply SAS congruence rule

In and :

Therefore, by the SAS congruence rule, .

(iv) Proving

Step 1: Use congruence from part (iii)

Since , (by CPCT).

Step 2: Use midpoint property

We know , and (given).

Therefore, .

Step 3: Relate AB and CM

Since , we have .

Therefore, .

ANSWER

(i) $\triangle AMC \cong \triangle BMD$

(ii) $\angle DBC$ is a right angle.

(iii) $\triangle DBC \cong \triangle ACB$

(iv) $CM = \frac{1}{2} AB$

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Key Formulas

Important Formulas for Exercise 7.1

Formula / Concept	Description
Congruent Triangles	Two triangles are congruent if their corresponding sides and angles are equal. This means they have the exact same size and shape. The symbol for congruence is \cong .
SAS (Side-Angle-Side) Congruence Rule	Two triangles are congruent if two sides and the included angle of one triangle are equal to the corresponding two sides and included angle of the other triangle.
ASA (Angle-Side-Angle) Congruence Rule	Two triangles are congruent if two angles and the included side of one triangle are equal to the corresponding two angles and included side of the other triangle.
SSS (Side-Side-Side) Congruence Rule	If the three sides of one triangle are equal to the corresponding three sides of another triangle, then the two triangles are congruent.
RHS (Right angle-Hypotenuse-Side) Congruence Rule	Two right-angled triangles are congruent if the hypotenuse and one side of one triangle are equal to the hypotenuse and the corresponding side of the other triangle.
CPCT (Corresponding Parts of Congruent Triangles)	If two triangles are congruent, then their corresponding parts (sides and angles) are equal. This is often used as a justification in proofs after congruence has been established.
Angle-Side Inequality Theorem	If two sides of a triangle are unequal, the angle opposite to the longer side is larger. Conversely, the side opposite to the larger angle is longer.

Top FAQs

Q1. How many questions are in NCERT Solutions Class 9 Maths Chapter 7 Triangles Exercise 7.1?

Exercise 7.1 of NCERT Solutions for Class 9 Maths Chapter 7 Triangles contains exactly 8 questions. These questions focus on the fundamental concepts of congruence of triangles and their properties. The NCERT Solutions Class 9 Maths Chapter 7 Exercise 7.1 provides step by step solutions for all 8 problems to help students prepare for CBSE board exam 2025-26.

Q2. Where can I download free PDF of NCERT Solutions for Class 9 Maths Chapter 7 Triangles Exercise 7.1?

You can download the free PDF of NCERT Solutions for Class 9 Maths Chapter 7 Triangles Exercise 7.1 from the official NCERT website or trusted educational platforms. The PDF includes step by step solutions for all 8 questions covering congruence of triangles concepts. These downloadable NCERT Solutions Class 9 Maths are updated according to the CBSE 2025-26 syllabus and are available at no cost.

Q3. How many marks does Chapter 7 Triangles carry in CBSE Class 9 Maths board exam 2025-26?

Chapter 7 Triangles carries approximately 6 marks in the CBSE Class 9 Maths board exam 2025-26 as part of Unit IV - Geometry. The weightage is shared with other geometry chapters, making NCERT Solutions for Class 9 Maths Chapter 7 Exercise 7.1 crucial for scoring well. Students should focus on congruence rules (SAS, ASA, SSS, RHS) to secure these marks in the examination.

Q4. Which is the most difficult question in Exercise 7.1 of NCERT Solutions Class 9 Maths Chapter 7 Triangles?

Question 8 in Exercise 7.1 of NCERT Solutions Class 9 Maths Chapter 7 Triangles is considered the most challenging by students as it requires application of multiple congruence criteria. This question tests understanding of SAS, ASA, SSS, and RHS postulates simultaneously. The step by step solutions provided in NCERT Class 9 Maths help students break down this complex problem for better comprehension.

Q5. What is Congruence of Triangles (SAS, ASA, SSS, RHS) explained in NCERT Solutions Class 9 Maths Chapter 7 Exercise 7.1?

Congruence of Triangles in NCERT Solutions Class 9 Maths Chapter 7 Exercise 7.1 means two triangles are identical in shape and size with four main criteria: SAS (Side-Angle-Side), ASA (Angle-Side-Angle), SSS (Side-Side-Side), and RHS (Right angle-Hypotenuse-Side). These congruence rules help prove that corresponding parts of triangles are equal. Understanding these concepts is essential for CBSE board exam 2025-26 and solving Exercise 7.1 problems effectively.

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