

ASA and AAS Triangle Congruence

Geometry Worksheet · Grade 8–10

Name: _____

Date: _____

Learning Objectives

- Identify and apply the Angle-Side-Angle (ASA) postulate to prove triangle congruence
- Identify and apply the Angle-Angle-Side (AAS) postulate to prove triangle congruence
- Distinguish between included and non-included sides in the context of triangle congruence

Problems

1. State the ASA Postulate in your own words: what three parts of two triangles must be congruent?

2. In triangle ABC and triangle DEF, if $\angle A \cong \angle D$, $AC \cong DF$, and $\angle C \cong \angle F$, which postulate proves the triangles congruent?

$$\angle A \cong \angle D, AC \cong DF, \angle C \cong \angle F$$

3. In triangle ABC and triangle DEF, if $\angle A \cong \angle D$, $\angle B \cong \angle E$, and $AC \cong DF$, which postulate proves the triangles congruent?

$$\angle A \cong \angle D, \angle B \cong \angle E, AC \cong DF$$

4. Explain the difference between an included side and a non-included side as used in the ASA and AAS postulates.

5. Four triangles are labeled A, B, C, and D. Triangles A and C each show the pattern angle-angle-side (AAS), while triangles B and D each show angle-side-angle (ASA). Which pairs of triangles are congruent by ASA?

6. Given that DB bisects $\angle ABC$, identify the two congruent angles this creates and write a congruence statement for them.

$$\angle 1 \cong \angle 2$$

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7. In a two-column proof showing $\triangle ABD \cong \triangle CBD$ by ASA, list the three statements (in order) that form the 'if' part of the proof, given that DB bisects $\angle ABC$ and $\angle 3 \cong \angle 4$.

$$\angle 1 \cong \angle 2, DB \cong DB, \angle 3 \cong \angle 4$$

8. Determine whether the following information is sufficient to prove triangle congruence by ASA or AAS, or neither: $\angle P \cong \angle X$, $PQ \cong XY$, $\angle R \cong \angle Z$ in triangles PQR and XYZ.

$$\angle P \cong \angle X, PQ \cong XY, \angle R \cong \angle Z$$

9. Write a complete two-column proof to show $\triangle ABD \cong \triangle CBD$ given: DB bisects $\angle ABC$ (so $\angle 1 \cong \angle 2$) and $\angle 3 \cong \angle 4$, with DB as the shared side.

$$\triangle ABD \cong \triangle CBD$$

10. Triangle MNP and triangle QRS have $\angle M \cong \angle Q$ and $\angle N \cong \angle R$. If you are told that $NP \cong RS$, prove or disprove that the triangles are congruent, and if so, state which postulate applies.

$$\angle M \cong \angle Q, \angle N \cong \angle R, NP \cong RS$$

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ASA and AAS Triangle Congruence — Answer Key

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Answer Key

1. Answer: Two angles and the included side of one triangle must be congruent to two angles and the included side of the other triangle.

- Recall that ASA stands for Angle-Side-Angle.
 - The side must be between (included by) the two congruent angles.
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2. Answer: ASA Postulate

- Identify the pattern: angle, then side AC (between $\angle A$ and $\angle C$), then angle — this is Angle-Side-Angle.
 - Since the side AC is included between the two congruent angles, the ASA Postulate applies.
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3. Answer: AAS Postulate

- Side AC is not between $\angle A$ and $\angle B$ ($\angle B$ is at vertex B, which is not an endpoint of AC), making AC a non-included side.
 - Two angles and a non-included side match the AAS Postulate.
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4. Answer: An included side lies directly between the two angles being used; a non-included side does not connect both of those angles.

- An included side shares both endpoints with the two angles in question.
 - A non-included side has at least one endpoint that is not one of the two angles being compared.
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5. Answer: Triangles B and D are congruent by ASA.

- Identify the marking pattern for each triangle: B and D both show angle-side-angle.
 - Because B and D share the same ASA pattern with corresponding congruent parts, they are congruent by ASA.
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6. Answer: $\angle 1 \cong \angle 2$ (the bisector divides $\angle ABC$ into two equal halves)

- A bisector divides an angle into two congruent parts.
 - Therefore $\angle ABD$ ($\angle 1$) \cong $\angle DBC$ ($\angle 2$) by the definition of an angle bisector.
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7. Answer: $\angle 1 \cong \angle 2$ (given/def. of bisector), $DB \cong DB$ (Reflexive Property), $\angle 3 \cong \angle 4$ (given)

- Statement 1: $\angle 1 \cong \angle 2$ — Reason: DB bisects $\angle ABC$ (given), definition of angle bisector.
 - Statement 2: $DB \cong DB$ — Reason: Reflexive Property of Congruence.
 - Statement 3: $\angle 3 \cong \angle 4$ — Reason: Given.
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8. Answer: AAS Postulate (side PQ is non-included since $\angle R$ is not at vertex Q relative to the pair $\angle P$ and $\angle R$)

- Check if the side PQ lies between the two congruent angles $\angle P$ and $\angle R$: PQ connects vertices P and Q, but $\angle R$ is at vertex R — not an endpoint of PQ.
 - Since the side is non-included relative to $\angle P$ and $\angle R$, this matches the AAS Postulate.
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9. Answer: $\triangle ABD \cong \triangle CBD$ by ASA Postulate

- Statement 1: $\angle 1 \cong \angle 2$ | Reason: DB bisects $\angle ABC$; Definition of Angle Bisector.
 - Statement 2: $DB \cong DB$ | Reason: Reflexive Property of Congruence.
 - Statement 3: $\angle 3 \cong \angle 4$ | Reason: Given.
 - Statement 4: $\triangle ABD \cong \triangle CBD$ | Reason: ASA Postulate (\angle -side- \angle pattern confirmed).
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10. Answer: Yes, $\triangle MNP \cong \triangle QRS$ by AAS Postulate

- Identify the two pairs of congruent angles: $\angle M \cong \angle Q$ and $\angle N \cong \angle R$.
 - Check whether NP is the included side between $\angle N$ and $\angle P$ — since $\angle M$ (not $\angle P$) is used instead, NP is a non-included side with respect to $\angle M$ and $\angle N$.
 - Two congruent angles and a non-included corresponding side satisfy the AAS Postulate, so $\triangle MNP \cong \triangle QRS$ by AAS.
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