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# SOLUTIONS: TRIANGLES

Mathematics | Class IX (2026/TRI/09/CBSE-ICSE/001)

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## Section A: Multiple Choice Questions

1. **Answer: (c) SSA**

SAS, ASA, and SSS are valid congruence criteria. SSA (Side-Side-Angle) is not a sufficient condition to prove two triangles are congruent.

2. **Answer: (b)  $50^\circ$**

In  $\triangle ABC$ , since  $AB = AC$ , the angles opposite to these sides are equal ( $\angle B = \angle C$ ). Thus, if  $\angle B = 50^\circ$ , then  $\angle C = 50^\circ$ .

3. **Answer: (c) Hypotenuse**

In a right-angled triangle, the side opposite to the  $90^\circ$  angle is the hypotenuse, and it is the longest side because it is opposite the largest angle.

4. **Answer: (a)  $AB = PQ$**

By CPCT (Corresponding Parts of Congruent Triangles), the corresponding sides and angles of congruent triangles are equal. Since the order is  $\triangle ABC \cong \triangle PQR$ ,  $AB$  corresponds to  $PQ$ .

5. **Answer: (a)  $AB^2 + AC^2 = BC^2$**

By the Pythagoras theorem, in a right triangle where  $\angle A = 90^\circ$ , the square of the hypotenuse ( $BC$ ) is equal to the sum of the squares of the other two sides.

## Section B: Short Answer Questions

6. **Congruence Criterion:** SAS (Side-Angle-Side).

**Relation:**  $\triangle ABC \cong \triangle PQR$ .

**Reasoning:** Two sides and the included angle of one triangle are equal to two sides and the included angle of the other.

7. In equilateral  $\triangle ABC$ ,  $AB = BC = CA$ .

Since  $AB = AC$ ,  $\angle B = \angle C$ . Since  $AB = BC$ ,  $\angle C = \angle A$ .

Therefore,  $\angle A = \angle B = \angle C$ .

By angle sum property:  $x + x + x = 180^\circ \implies 3x = 180^\circ \implies x = 60^\circ$ .

8. **Proof:** Given  $\angle BAD = \angle EAC$ .

Add  $\angle DAC$  to both sides:  $\angle BAD + \angle DAC = \angle EAC + \angle DAC \implies \angle BAC = \angle DAE$ .

In  $\triangle ABC$  and  $\triangle ADE$ :

$AB = AD$  (Given),  $AC = AE$  (Given),  $\angle BAC = \angle DAE$  (Proved above).

By SAS criterion,  $\triangle ABC \cong \triangle ADE$ .

Thus,  $BC = DE$  (By CPCT).

9. In  $\triangle PQR$ ,  $\angle P = 70^\circ$  and  $\angle Q = 40^\circ$ .

$\angle R = 180^\circ - (70^\circ + 40^\circ) = 70^\circ$ .

The largest angles are  $\angle P$  and  $\angle R$  ( $70^\circ$  each).

The longest sides are opposite these angles:  $QR$  and  $PQ$ .

**Justification:** In a triangle, the side opposite to the larger angle is longer. Since  $\angle P$  and  $\angle R$  are equal and the largest, their opposite sides  $QR$  and  $PQ$  are the longest.

## Section C: Long Answer Questions

10. **Proof:** Let  $\triangle ABC$  have  $AB = AC$ . Draw  $AD$  as the bisector of  $\angle A$  meeting  $BC$  at  $D$ .  
In  $\triangle ABD$  and  $\triangle ACD$ :  
 $AB = AC$  (Given),  $\angle BAD = \angle CAD$  (By construction),  $AD = AD$  (Common side).  
By SAS criterion,  $\triangle ABD \cong \triangle ACD$ .  
 $\implies \angle B = \angle C$  (By CPCT).
11. In  $\triangle BFC$  and  $\triangle CEB$ :  
 $\angle BFC = \angle CEB = 90^\circ$  (Altitudes),  $BC = BC$  (Common side),  $\angle B = \angle C$  (Opposite to equal sides  $AC = AB$ ).  
By AAS congruence,  $\triangle BFC \cong \triangle CEB$ .  
 $\implies BE = CF$  (By CPCT).
12. In  $\triangle ABD$  and  $\triangle ACD$ :  
 $AB = AC$  (Given),  $\angle ADB = \angle ADC = 90^\circ$  (Altitude),  $AD = AD$  (Common).  
By RHS congruence,  $\triangle ABD \cong \triangle ACD$ .  
(i)  $BD = CD$  (CPCT)  $\implies AD$  bisects  $BC$ .  
(ii)  $\angle BAD = \angle CAD$  (CPCT)  $\implies AD$  bisects  $\angle A$ .
13. In any triangle, the sum of two sides is greater than twice the median to the third side.  
 $AB + AC > 2AD$ ,  $AB + BC > 2BE$ ,  $BC + AC > 2CF$ .  
Adding these:  $2(AB + BC + AC) > 2(AD + BE + CF)$ .  
Dividing by 2:  $(AB + BC + AC) > (AD + BE + CF)$ .  
Perimeter  $>$  Sum of medians.

## Section D: Concept Checklist

1. The sum of any two sides of a triangle is always **greater** than the third side.
2. CPCT stands for **Corresponding Parts of Congruent Triangles**.
3. In  $\triangle ABC$ , if  $\angle B$  is the largest angle, then the side  $AC$  is the longest.
4. Two triangles are congruent if their **shape** and **size** are the same.