CLASS 10 – MATHEMATICS

SIMILARITY OF TRIANGLES

(AA, SAS and SSS)



1 WHAT ARE SIMILAR TRIANGLES?

- **Two triangles are similar** if their **corresponding angles** are equal and **their corresponding** sides are in the **same ratio.**
- The triangles have the same shape, but not necessarily the same size.

Notation:

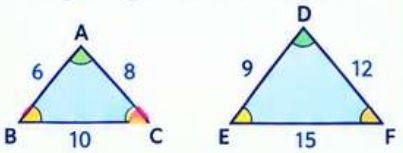
If $\triangle ABC \sim \triangle DEF$, then

$\angle A = \angle D, \quad \angle B = \angle E, \quad \angle C = \angle F$

and $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$

Example

In the given figure, $\triangle ABC \sim \triangle DEF$.



$\frac{AB}{DE} = \frac{6}{9} = \frac{2}{3}, \quad \frac{BC}{EF} = \frac{8}{12} = \frac{2}{3},$

$\frac{AC}{DF} = \frac{10}{15} = \frac{2}{3}$

So, $\triangle ABC \sim \triangle DEF$.

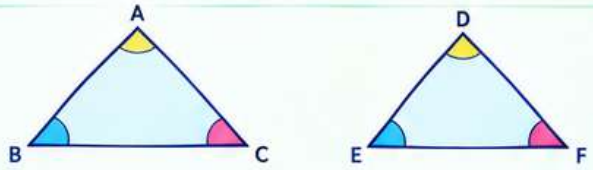
2 KEY CONCEPTS

- ★ **Similar triangles** have equal corresponding angles and proportional corresponding sides.
- ★ **BPT** (Basic Proportionality Theorem) gives a relation between the sides when a line is parallel to one side of a triangle.
- ★ **Converse of BPT** states that if a line divides two sides of a triangle in the same ratio, then it is parallel to the third side.

3 AA (ANGLE-ANGLE) CRITERION

Statement

If two angles of one triangle are equal to two angles of another triangle, then the triangles are similar.



$\angle A = \angle D$ and $\angle B = \angle E \Rightarrow \triangle ABC \sim \triangle DEF$

Example

In $\triangle ABC$ and $\triangle DEF$, $\angle A = 70°$ and $\angle D = 70°$, $\angle B = 60°$ and $\angle E = 60°$.

Therefore, $\triangle ABC \sim \triangle DEF$ (by AA criterion).

4 SAS (SIDE-ANGLE-SIDE) CRITERION

Statement

If two sides of one triangle are proportional to two sides of another triangle and the included angles are equal, then the triangles are similar.



If $\frac{AB}{DE} = \frac{BC}{EF}$ and $\angle B = \angle E \Rightarrow \triangle ABC \sim \triangle DEF$

Example

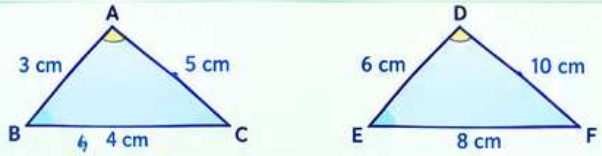
In $\triangle ABC$ and $\triangle DEF$, $AB = 6$ cm, $BC = 9$ cm, $DE = 8$ cm, $EF = 12$ cm and $\angle B = \angle E$.

Therefore, $\triangle ABC \sim \triangle DEF$ (by SAS criterion).

5 SSS (SIDE-SIDE-SIDE) CRITERION

Statement

If the three sides of one triangle are proportional to the three sides of another triangle, then the triangles are similar.



If $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF} \Rightarrow \triangle ABC \sim \triangle DEF$

Example

In $\triangle ABC$ and $\triangle DEF$, $AB = 3$ cm, $BC = 4$ cm, $AC = 5$ cm and $DE = 6$ cm, $EF = 8$ cm, $DF = 10$ cm.

Therefore, $\triangle ABC \sim \triangle DEF$ (by SSS criterion).

6 IMPORTANT POINTS

- ★ Similar triangles are not necessarily congruent. Congruent triangles are always similar, but similar triangles need not be congruent.
- ★ Corresponding sides are proportional in the same order as corresponding angles.
- ★ The ratio of corresponding sides is called the scale factor.
- ★ In similar triangles, the ratio of areas is equal to the square of the ratio of corresponding sides.
- ★ If one pair of corresponding sides is given, the other sides can be found using the ratio.

7 COMMON VARIATIONS

1. In $\triangle ABC$, if $DE \parallel BC$, show that $\triangle ADE \sim \triangle ABC$.
2. In $\triangle ABC$ and $\triangle DEF$, if $\angle A = \angle D$, $\angle B = \angle E$ and $AB = 2DE$, find the ratio of their perimeters.
3. If $\triangle ABC \sim \triangle DEF$ and $AB : DE = 3 : 5$, find the ratio of their areas.
4. In $\triangle ABC$, D is on AB and E is on AC such that $DE \parallel BC$. If $AD = 2$ cm, $DB = 3$ cm and $AE = 4$ cm, find EC.
5. If $\triangle ABC \sim \triangle DEF$, $AB = 6$ cm, $AC = 9$ cm and $DE = 4$ cm, find DF.

8 QUICK REVISION

Similar Triangles:

$\angle A = \angle D, \quad \angle B = \angle E, \quad \angle C = \angle F$

and $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$

BPT:

In a triangle, if a line is parallel to one side, then it divides the other two sides in the same ratio.

Converse of BPT:

If a line divides two sides of a triangle in the same ratio, then it is parallel to the third side.

AA | SAS | SSS

9 KEY TAKEAWAY

To prove two triangles are similar, look for:

- ✔ Equal angles (AA)
- ✔ Two sides in ratio and included angle equal (SAS)
- ✔ All three sides in ratio (SSS)

Same shape... Different size... Still similar!

★ Think • Apply • Score Higher ★