



# TRIANGLES

(Similar Triangles, BPT Theorem & Converse of BPT Theorem)

## 1 SIMILAR TRIANGLES

**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:**

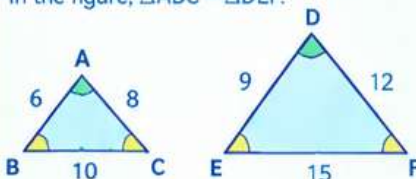
If  $\triangle ABC \sim \triangle DEF$ , then

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

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

**Example**

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



$$\frac{AB}{DE} = \frac{6}{9} = \frac{2}{3}, \quad \frac{BC}{EF} = \frac{10}{15} = \frac{2}{3},$$

$$\frac{AC}{DF} = \frac{8}{12} = \frac{2}{3}$$

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

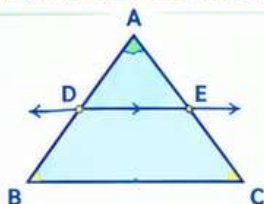
## 2 KEY CONCEPTS

- 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 BASIC PROPORTIONALITY THEOREM (BPT)

**Statement**

If a line is drawn parallel to one side of a triangle and intersects the other two sides in distinct points, then the other two sides are divided in the same ratio.



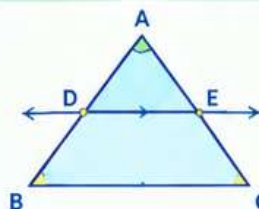
Therefore,

$$\frac{AD}{DB} = \frac{AE}{EC}$$

## 4 CONVERSE OF BPT

**Statement**

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



If

$$\frac{AD}{DB} = \frac{AE}{EC}$$

then  $DE \parallel BC$ .

## 5 SOLVING USING BPT

**Steps**

- Identify the given parallel line and the triangle.
- Write the ratio using BPT.
- Substitute the given values.
- Solve for the unknown.

**Example**

In  $\triangle ABC$ ,  $DE \parallel BC$ . If  $AD = 3$  cm,  $DB = 6$  cm and  $AE = 4.5$  cm, find  $EC$ .

**Solution:**

$$\frac{AD}{DB} = \frac{AE}{EC} \Rightarrow \frac{3}{6} = \frac{4.5}{EC} \Rightarrow EC = 9 \text{ cm}$$

## 6 SOLVING USING CONVERSE BPT

**Steps**

- Identify the given ratio of sides.
- Check if the ratio is equal.
- Conclude that the line is parallel to the third side.

**Example**

In  $\triangle ABC$ , D and E are points on AB and AC such that  $\frac{AD}{DB} = \frac{2}{3}$  and  $\frac{AE}{EC} = \frac{2}{3}$ . Show that  $DE \parallel BC$ .

**Solution:** Since  $\frac{AD}{DB} = \frac{AE}{EC} = \frac{2}{3}$ , by the converse of BPT,  $DE \parallel BC$ .

## 7 IMPORTANT POINTS

- BPT and its converse are based on the idea of proportionality.
- Be careful with the order of sides in the ratio (matching the corresponding sides).
- The given line must be parallel to the required side (in BPT).
- In the converse, the ratio must be exact (not just approximately equal).

## 8 COMMON VARIATIONS

- Find an unknown length using BPT.
- Prove a line is parallel using the converse.
- Find the ratio of segments using similarity and BPT.
- Use BPT in real-life or word problems (e.g., height, shadow, distance).

**Example (Variation)**

In  $\triangle ABC$ ,  $DE \parallel BC$ . If  $AD = x + 2$ ,  $DB = 4$ ,  $AE = x + 3$ ,  $EC = 6$ . Find  $x$ .

**Solution:**  $\frac{x+2}{4} = \frac{x+3}{6} \Rightarrow 6(x+2) = 4(x+3)$

$$\Rightarrow 6x + 12 = 4x + 12 \Rightarrow 2x = 0 \Rightarrow x = 0$$

## 9 QUICK REVISION

**Similar Triangles:**

angle and corresponding sides in same ratio.

**BPT:**

Line  $\parallel$  side  $\Rightarrow$  other two sides are divided in the same ratio.

**Converse BPT:**

Same ratio of sides  $\Rightarrow$  line  $\parallel$  third side.

**Remember the Ratio Order:**

$$\frac{AD}{DB} = \frac{AE}{EC} \quad (\text{Sides opposite to equal angles})$$

## 10 KEY TAKEAWAY



Similar triangles help us compare shapes.

BPT and its converse help us find unknown lengths, prove parallel lines and solve real-life problems.

Same shape...  
Same angles...  
Proportional sides!



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