



1. Chapter Overview & Exam Weightage Analysis

CHAPTER AT A GLANCE

Triangles is one of the highest-weightage chapters in Class 10 Geometry (Unit: Geometry carries 15 Marks total). This chapter focuses primarily on **Similarity of Triangles**, **Basic Proportionality Theorem (Thales Theorem)**, its Converse, and **Criteria for Similarity (AAA, SAS, SSS)**.

- **Expected Weightage:** 6 to 9 Marks in CBSE Board Examination.
- **Question Types:** 1 MCQ (1M), 1 Short Answer / Theorem Proof (3M or 5M), 1 Case Study / Competency Question (4M).
- **Core Skill Tested:** Proving theorems step-by-step with reasons, applying ratio properties, identifying similar triangles in complex figures.



2. Congruence vs Similarity (Zero to Hero Concept)

Before diving into theorems, let us establish the fundamental mathematical distinction between Congruent and Similar figures.

Feature	Congruent Figures (सर्वांगसम) $\cong$	Similar Figures (समरूप) $\sim$
Shape	Must be Exactly the SAME	Must be Exactly the SAME
Size	Must be Exactly the SAME	Can be DIFFERENT (Scaled up/down)
Corresponding Angles	Equal ($\angle A = \angle D$)	Equal ($\angle A = \angle D$)
Corresponding Sides	Equal ($AB = DE$)	Proportional ($AB/DE = BC/EF = AC/DF$)
Real-Life Analogy	Two identical ₹10 coins	A passport photo vs its enlarged wall poster



GOLDEN RULE OF SIMILARITY

Two polygons (or triangles) of the same number of sides are **SIMILAR** if and only if:

1. Their corresponding angles are **EQUAL**.



2. Their corresponding sides are in the **SAME RATIO (PROPORTIONAL)**.

Note: All congruent figures are similar, but all similar figures are NOT necessarily congruent!

TINKU SIR TRICK #1: THE PHOTO-ZOOM RULE

Think of similarity like zooming in/out on a smartphone screen! When you pinch and zoom a photo, the **angles NEVER change**, but all **side lengths expand or shrink by the exact same scale factor (k)**. If sides double, perimeter doubles, but angles remain 100% identical!



3. Basic Proportionality Theorem (Thales Theorem) & Proof

THEOREM 6.1: BASIC PROPORTIONALITY THEOREM (BPT)

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

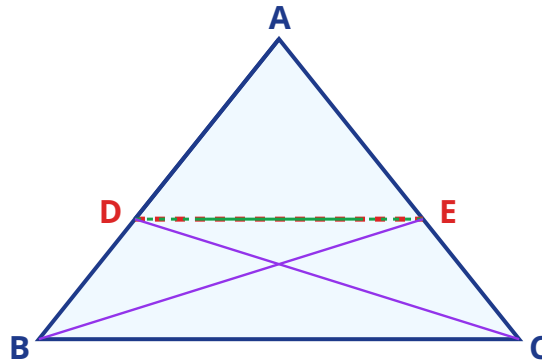


Figure 6.1: Triangle ABC with $DE \parallel BC$ intersecting AB at D and AC at E



STEP-BY-STEP BOARD PROOF OF BPT (5-MARK GUARANTEED PATTERN)



GIVEN: A triangle $\triangle ABC$ in which a line parallel to side BC intersects side AB at D and side AC at E (i.e., $DE \parallel BC$).



TO PROVE: $AD / DB = AE / EC$



CONSTRUCTION:

1. Join BE and CD .
2. Draw $EN \perp AB$ and $DM \perp AC$.



PROOF:

- Area of $\triangle ADE = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times AD \times EN$ ---- (Equation 1)
- Area of $\triangle BDE = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times DB \times EN$ ---- (Equation 2)

→ Dividing Eq (1) by Eq (2):

$$\text{Area}(\triangle ADE) / \text{Area}(\triangle BDE) = (\frac{1}{2} \times AD \times EN) / (\frac{1}{2} \times DB \times EN) = AD / DB \text{ ---- (Equation 3)}$$

→ Similarly, Area of $\triangle ADE = \frac{1}{2} \times AE \times DM$ and Area of $\triangle DEC = \frac{1}{2} \times EC \times DM$.

$$\text{Area}(\triangle ADE) / \text{Area}(\triangle DEC) = (\frac{1}{2} \times AE \times DM) / (\frac{1}{2} \times EC \times DM) = AE / EC \text{ ---- (Equation 4)}$$

→ Notice that $\triangle BDE$ and $\triangle DEC$ lie on the **same base DE** and between the **same parallel lines DE and BC**.

Therefore, $\text{Area}(\triangle BDE) = \text{Area}(\triangle DEC)$ ---- (Equation 5)

→ From Equations (3), (4), and (5), the LHS of both ratios are equal. Hence:

$$AD / DB = AE / EC$$

Hence Proved! 🎉

🔥 TINKU SIR TRICK #2: THE "AREA RATIO RAT" FOR BPT PROOF

Remember the 3 steps of BPT Proof in your head:

1. Area with EN altitude → 2. Area with DM altitude → 3. Same base DE rule!

Always cancel out the altitude in step 1 & 2 to leave the side segments cleanly!

🚀 ONEPATH HACK #1: BPT EXTENDED FORMULAS

When $DE \parallel BC$, you can apply three forms depending on what is asked in the question:

- **Standard Form:** $AD / DB = AE / EC$
- **Upper-to-Whole Form:** $AD / AB = AE / AC$
- **Lower-to-Whole Form:** $DB / AB = EC / AC$

Shortcut Tip: Add 1 to both sides of $AD/DB = AE/EC$ to quickly derive the whole-side forms!

🚫 COMMON MISTAKE TO AVOID IN BPT

❌ **WRONG:** Writing $AD / DB = DE / BC$ using standard BPT!

✅ **CORRECT:** BPT only relates side segments on the split sides ($AD/DB = AE/EC$). To include the parallel bases DE and BC , you MUST use **Similarity of Triangles** ($\triangle ADE \sim \triangle ABC$), giving $AD / AB = DE / BC$!

🔄 4. Converse of Basic Proportionality Theorem

★ THEOREM 6.2: CONVERSE OF BPT

Statement: If a line divides any two sides of a triangle in the same ratio, then the line must be parallel to the third side.

Given: In $\triangle ABC$, $AD / DB = AE / EC$.

To Prove: $DE \parallel BC$.

Proof Strategy (Proof by Contradiction): Assume DE is NOT parallel to BC . Draw $DE' \parallel BC$. Apply BPT to get $AD / DB = AE' / E'C$. Compare with given condition to prove E and E' coincide!

5. Criteria for Similarity of Triangles

To prove two triangles similar, we don't need to check all 6 parameters (3 angles + 3 sides). We use these 3 main criteria:

Criterion	Mathematical Statement	Visual / Diagram Concept	Key Exam Tip
AAA / AA Criteria	If two angles of one triangle are equal to two angles of another triangle, the triangles are similar.	$\angle A = \angle D, \angle B = \angle E$ $\Rightarrow \triangle ABC \sim \triangle DEF$	Most commonly used in 90% of board problems! Find 2 equal angles.
SAS Criteria	If one angle of a triangle is equal to one angle of another triangle and sides including these angles are proportional.	$\angle A = \angle D$ and $AB/DE = AC/DF \Rightarrow \triangle ABC \sim \triangle DEF$	Angle MUST be strictly enclosed between the two proportional sides!
SSS Criteria	If in two triangles, sides of one triangle are proportional to sides of the other triangle.	$AB/DE = BC/EF = AC/DF \Rightarrow \triangle ABC \sim \triangle DEF$	Used when all 6 side lengths are given/asked without angle data.

TINKU SIR TRICK #3: ORDER OF LETTERS MATTERS!

When writing similarity statements, **LETTER CORRESPONDENCE IS HOLY!**

If $\angle A = \angle E$, $\angle B = \angle F$, and $\angle C = \angle D$, you **MUST** write:

$\triangle ABC \sim \triangle EFD$ (Not $\triangle DEF$!).

From $\triangle ABC \sim \triangle EFD$, automatically write side ratios by matching positions:

$AB/EF = BC/FD = AC/ED$. No visual confusion!

ONEPATH HACK #2: THE "BOW-TIE" & "RIGHT-TRIANGLE OVERLAP" PATTERNS

CBSE board exam questions frequently use two geometric templates:

- **1. Bow-Tie Pattern (Intersecting lines):** Two lines crossing like an X inside parallel lines. Use Vertically Opposite Angles + Alternate Interior Angles $\rightarrow$ **AA Similarity!**
- **2. Right Triangle with Shared Angle:** A small right triangle inside a larger right triangle sharing one acute angle $\rightarrow$ **AA Similarity** instantly!

6. Question Identification System

QUESTION DEKHO $\rightarrow$ TYPE PECHANO $\rightarrow$ METHOD CHUNO

Use this decision matrix during your board exam to immediately know what method to trigger:

If Question Contains / Asks For...	Think Of Concept...	Formula / Theorem To Apply
Parallel line given inside triangle ($DE \parallel BC$)	Basic Proportionality Theorem	$AD/DB = AE/EC$

If Question Contains / Asks For...	Think Of Concept...	Formula / Theorem To Apply
Show line is parallel (Prove $DE \parallel BC$)	Converse of BPT	Calculate ratios AD/DB and AE/EC . If equal $\Rightarrow DE \parallel BC$
Ratio of sides in non-parallel setup	Similar Triangles	Prove $\Delta 1 \sim \Delta 2$ using AA/SAS $\rightarrow$ Sides in ratio
Product of sides given (e.g. $PA \cdot PB = PC \cdot PD$)	Cross-multiplication of ratios	Convert to $PA/PC = PD/PB \rightarrow$ Prove $\Delta PAC \sim \Delta PDB$
Shadow of a pole/person cast by light source	AA Similarity	$Height_1/Height_2 = Shadow_1/Shadow_2$
Trapezium with non-parallel sides & diagonals	BPT or Similarity of Diagonals	Diagonals divide each other proportionally ($AO/OC = BO/OD$)



7. Comprehensive Solved Examples (Board Level)

MOST EXPECTED

CBSE 2024 / 2023

Example 1: BPT Application with Algebraic Expressions

QUESTION: In ΔABC , $DE \parallel BC$ such that $AD = x$, $DB = x - 2$, $AE = x + 2$, and $EC = x - 1$. Find the value of x .

CONCEPT IDENTIFICATION: Parallel line $DE \parallel BC$ given $\rightarrow$ Apply BPT.

GIVEN: $AD = x$, $DB = x - 2$, $AE = x + 2$, $EC = x - 1$.

TO FIND: Value of x .

STEP-BY-STEP SOLUTION:

$\rightarrow$ Since $DE \parallel BC$ in ΔABC , by Basic Proportionality Theorem (BPT):

$$AD / DB = AE / EC$$

$\rightarrow$ Substitute the given algebraic terms:

$$x / (x - 2) = (x + 2) / (x - 1)$$

$\rightarrow$ Cross-multiply to solve for x :

$$x(x - 1) = (x + 2)(x - 2)$$

$\rightarrow$ Expand both sides:

$$x^2 - x = x^2 - 4 \text{ (using identity } (a+b)(a-b) = a^2 - b^2 \text{)}$$

$\rightarrow$ Cancel x^2 from both sides:

$$-x = -4 \Rightarrow x = 4$$

FINAL ANSWER: $x = 4$ cm.



TINKU SIR QUICK CHECK

Plug $x = 4$ back into ratios: $AD/DB = 4/2 = 2$. $AE/EC = 6/3 = 2$. Ratios match perfectly ($2 = 2$)! Answer verified in 5 seconds!

HOTS

CBSE 2025 VERIFIED

Example 2: Trapezium Diagonal Property Proof

QUESTION: $ABCD$ is a trapezium with $AB \parallel DC$. Diagonals AC and BD intersect each other at point O . Show that $AO / BO = CO / DO$.

 **CONCEPT IDENTIFICATION:** Proving diagonal ratio in Trapezium → Method 1: BPT with construction OR Method 2: Similar Triangles.

METHOD 1 — STANDARD CBSE METHOD (Using Similar Triangles):

- In $\triangle AOB$ and $\triangle COD$:
- $\angle AOB = \angle COD$ (Vertically Opposite Angles)
- $\angle OAB = \angle OCD$ (Alternate Interior Angles as $AB \parallel DC$)
- Therefore, by **AA Similarity Criterion**, $\triangle AOB \sim \triangle COD$.
- Since corresponding sides of similar triangles are proportional:
 $AO / CO = BO / DO$
- Rearranging terms (cross-swapping BO and CO):
 $AO / BO = CO / DO$

Hence Proved! 



8. Verified CBSE Board Past Year Questions (2023 - 2026)

 **VERIFIED CBSE PYQ 2023** (3 Marks)

Question: In the given figure, $DE \parallel AC$ and $DF \parallel AE$. Prove that $BF / FE = BE / EC$.

Solution (CBSE Marking Scheme Style):

- In $\triangle ABE$, given $DF \parallel AE$.
By BPT: $BD / DA = BF / FE$ ---- (1) [1 Mark]
- In $\triangle ABC$, given $DE \parallel AC$.
By BPT: $BD / DA = BE / EC$ ---- (2) [1 Mark]
- From equations (1) and (2), LHS is identical (BD / DA).
Equating RHS: $BF / FE = BE / EC$. [1 Mark]

Hence Proved!

 VERIFIED CBSE PYQ 2024 (2 Marks MCQ / Short)

Question: A vertical pole of length 6 m casts a shadow 4 m long on the ground and at the same time a tower casts a shadow 28 m long. Find the height of the tower.

Solution:

- At the same time, the angle of elevation of the sun is identical for both objects.
- Triangle formed by pole ($\triangle ABC$) $\sim$ Triangle formed by tower ($\triangle PQR$) by **AA Similarity**.
- Ratio of sides: **Height of Pole / Height of Tower = Shadow of Pole / Shadow of Tower**
- $6 / h = 4 / 28$
- $4 \times h = 6 \times 28 \Rightarrow h = (6 \times 28) / 4 = 42$ meters.

 **Answer:** Height of tower = 42 m.

 CBSE-STYLE / PYQ PATTERN 2026 (4 Marks Case Study)

Context: Scale drawings and triangle geometry in architectural bridge design.

Question: A triangular truss $\triangle ABC$ has a support beam DE parallel to base BC . If $AD = 3$ cm, $AB = 9$ cm, and length of $BC = 15$ cm, calculate the length of support beam DE .

Solution:

- In $\triangle ADE$ and $\triangle ABC$, $DE \parallel BC$.
- $\angle ADE = \angle ABC$ (Corresponding angles) and $\angle A = \angle A$ (Common angle).
- By AA Similarity, $\triangle ADE \sim \triangle ABC$.
- Therefore: $AD / AB = DE / BC$
- Substitute values: $3 / 9 = DE / 15 \Rightarrow 1/3 = DE / 15 \Rightarrow DE = 15 / 3 = 5$ cm.

 **Answer:** Support beam length $DE = 5$ cm.

9. Students Often Make These Mistakes!

MISTAKE #1: WRONG TRIANGLE NAMING ORDER

 **WRONG:** Writing $\triangle ABC \sim \triangle DEF$ when $\angle A = \angle E$.

 **CORRECT:** Match equal vertices strictly! If $A \leftrightarrow E$, $B \leftrightarrow D$, $C \leftrightarrow F$, write $\triangle ABC \sim \triangle EDF$.

 **HOW TO AVOID IT:** Write corresponding equal angles on top of each other before naming triangles.

MISTAKE #2: FORGETTING REASONS IN PROOFS

✗ WRONG: Writing $\angle 1 = \angle 2$ without stating why in board answers.

✓ CORRECT: Always write justification in brackets: e.g., $\angle 1 = \angle 2$ (Alternate interior angles, $DE \parallel BC$).

💡 HOW TO AVOID IT: CBSE marking scheme deducts $\frac{1}{2}$ mark per missing reason in geometry proofs!

10. Concept-Wise Practice Set (Basic to HOTS)

● LEVEL 1 — BASIC (1-2 Marks)

1. In $\triangle ABC$, $DE \parallel BC$. If $AD = 2.4$ cm, $DB = 3.6$ cm, and $EC = 5$ cm, find AE . (Ans: 3.33 cm)
2. Are all equilateral triangles similar? State True/False with reason. (Ans: True, all angles = 60°)

● LEVEL 2 — APPLICATION (3 Marks)

1. E is a point on side AD produced of a parallelogram $ABCD$ and BE intersects CD at F . Show that $\triangle ABE \sim \triangle CFB$.
2. In figure, ALTITUDES AD and CE of $\triangle ABC$ intersect each other at point P . Prove that $\triangle AEP \sim \triangle CDP$.

● LEVEL 3 — HOTS / BOARD CHALLENGE (4-5 Marks)

1. State and Prove Basic Proportionality Theorem (Thales Theorem).
2. In a quadrilateral $ABCD$, diagonals AC and BD intersect at O such that $AO/BO = CO/DO$. Prove that $ABCD$ is a trapezium.

11. Complete Chapter Mind Map



CHAPTER 6: TRIANGLES (CLASS 10)

1. CONGRUENCE VS SIMILARITY

- Same shape + Same size = **Congruent** ($\cong$)
- Same shape + Different size = **Similar** ($\sim$)
- Ratios of corresponding sides equal
- Corresponding angles equal

2. THALES THEOREM (BPT)

- If $DE \parallel BC \rightarrow AD/DB = AE/EC$
- Converse: If ratio equal $\rightarrow DE \parallel BC$
- Proof: Area of triangles with shared altitude
- Shortcut: Upper/Whole = Lower/Whole

3. SIMILARITY CRITERIA

- **AAA / AA:** 2 angles equal
- **SAS:** 2 sides proportional + enclosed angle
- **SSS:** All 3 sides in same ratio
- Order of letters is CRITICAL!

12. OnePath One-Page Quick Revision Sheet

LAST-MINUTE FORMULA & THEOREM SUMMARY SHEET

BPT Basic Form:

$$AD / DB = AE / EC \text{ (when } DE \parallel BC \text{)}$$

BPT Extended Form:

$$AD / AB = AE / AC = DE / BC \text{ (using } \triangle ADE \sim \triangle ABC \text{)}$$

Trapezium Diagonals:	$AO / CO = BO / DO$ or $AO / BO = CO / DO$
Shadow / Tower Formula:	$Height_1 / Height_2 = Shadow_1 / Shadow_2$
Mid-point Theorem (Class 9 recall):	If D, E are midpoints $\rightarrow DE \parallel BC$ and $DE = \frac{1}{2} BC$

5 COMMANDMENTS TO SCORE 100% IN TRIANGLES

1. **Always draw a clean diagram** in pencil for every geometry question, marking parallel lines with arrows!
2. **State 'Given', 'To Prove', and 'Construction'** clearly before starting any proof!
3. **Give reason in brackets** for EVERY angle equality or ratio equation.
4. **Verify letter matching:** Double-check if $\triangle ABC \sim \triangle DEF$ matches corresponding equal angles!
5. **Never confuse BPT with Similarity:** Use BPT for side splits (AD/DB); use Similarity for bases (DE/BC)!

13. Final Chapter Checklist

- ☒ All NCERT concepts & definitions understood
- ☒ Proof of Basic Proportionality Theorem (BPT) practiced 3 times on paper
- ☒ Proof of Converse of BPT understood
- ☒ AAA, SAS, SSS similarity criteria clear
- ☒ Tinku Sir Tricks & OnePath Hacks applied to sample problems
- ☒ Verified CBSE PYQs 2023-2026 solved
- ☒ Common mistakes reviewed to avoid mark loss
- ☒ Mind map and Quick Revision Sheet revised before exam