Geometry Chapter–1 (BSE Odisha): SIMILARITY OF TRIANGLES
ଜ୍ୟାମିତି ଅଧ୍ୟାୟ–1 : ତ୍ରିଭୁଜର ସଦୃଶତା
(As prescribed by Board of Secondary Education Odisha)

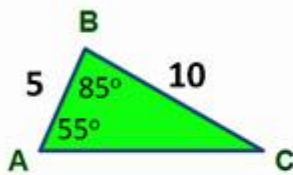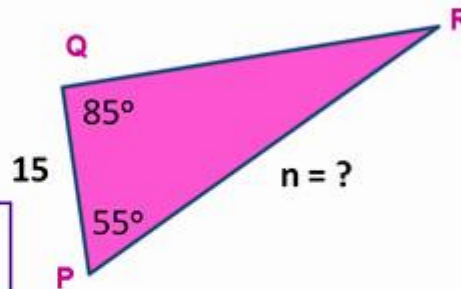## CLASS X – GEOMETRY
CHAPTER–1 : SIMILARITY OF TRIANGLES
ତ୍ରିଭୁଜର ସଦୃଶତା

Similar Triangles – Example 3A

Prove these are Similar Triangles and then find the value of "n"

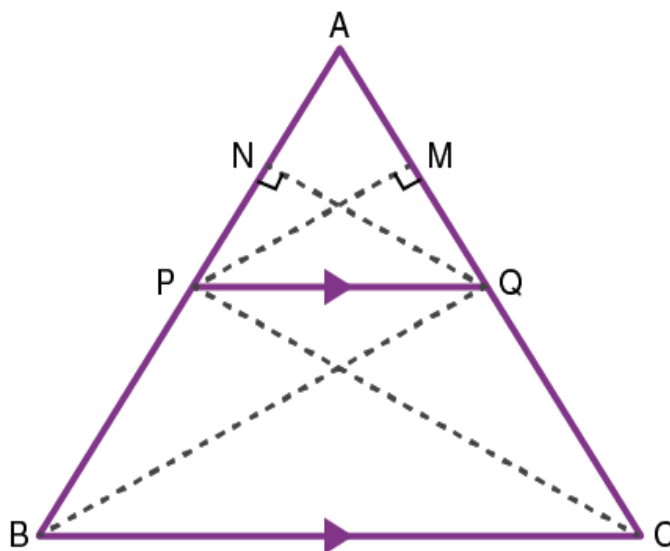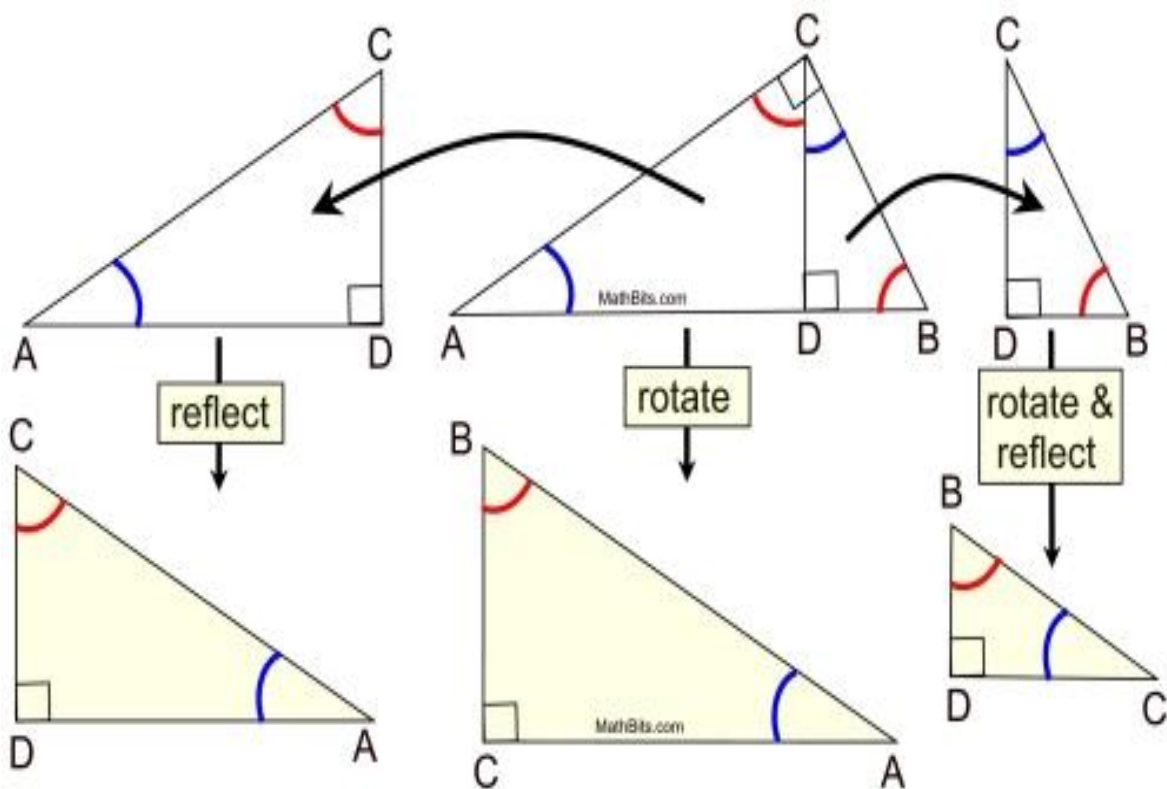We know the third angle is 40° so $\triangle ABC \sim \triangle PQR$ by AAA.

$$\frac{PQ}{AB} = \frac{15}{5} = 3$$

This Scale Factor of S.F. = 3 tells us that $\triangle PQR$ is three times bigger than $\triangle ABC$.

Using the Scale Factor of 3:

$$n = 3 \times 10 = 30 \checkmark$$

1. INTRODUCTION

Introduction | ପରିଚୟ

English

Two triangles are said to be **similar** if:
- Their **corresponding angles are equal**
- Their **corresponding sides are in the same ratio**

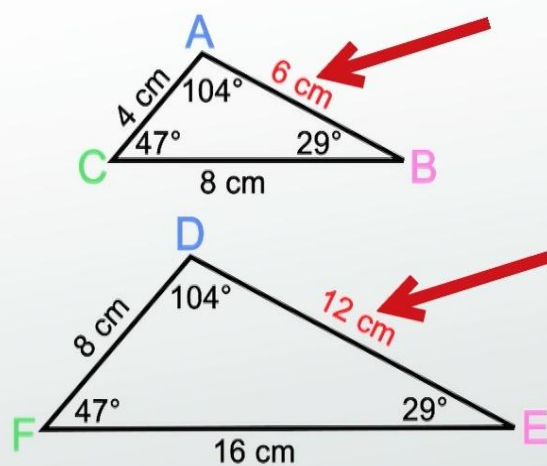Similar triangles have the **same shape** but may differ in **size**.

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ଦୁଇଟି ତ୍ରିଭୁଜକୁ **ସଦୃଶ** କୁହାଯାଏ ଯଦି—
- ସମ୍ବନ୍ଧିତ କୋଣଗୁଡ଼ିକ ସମାନ ହୁଏ
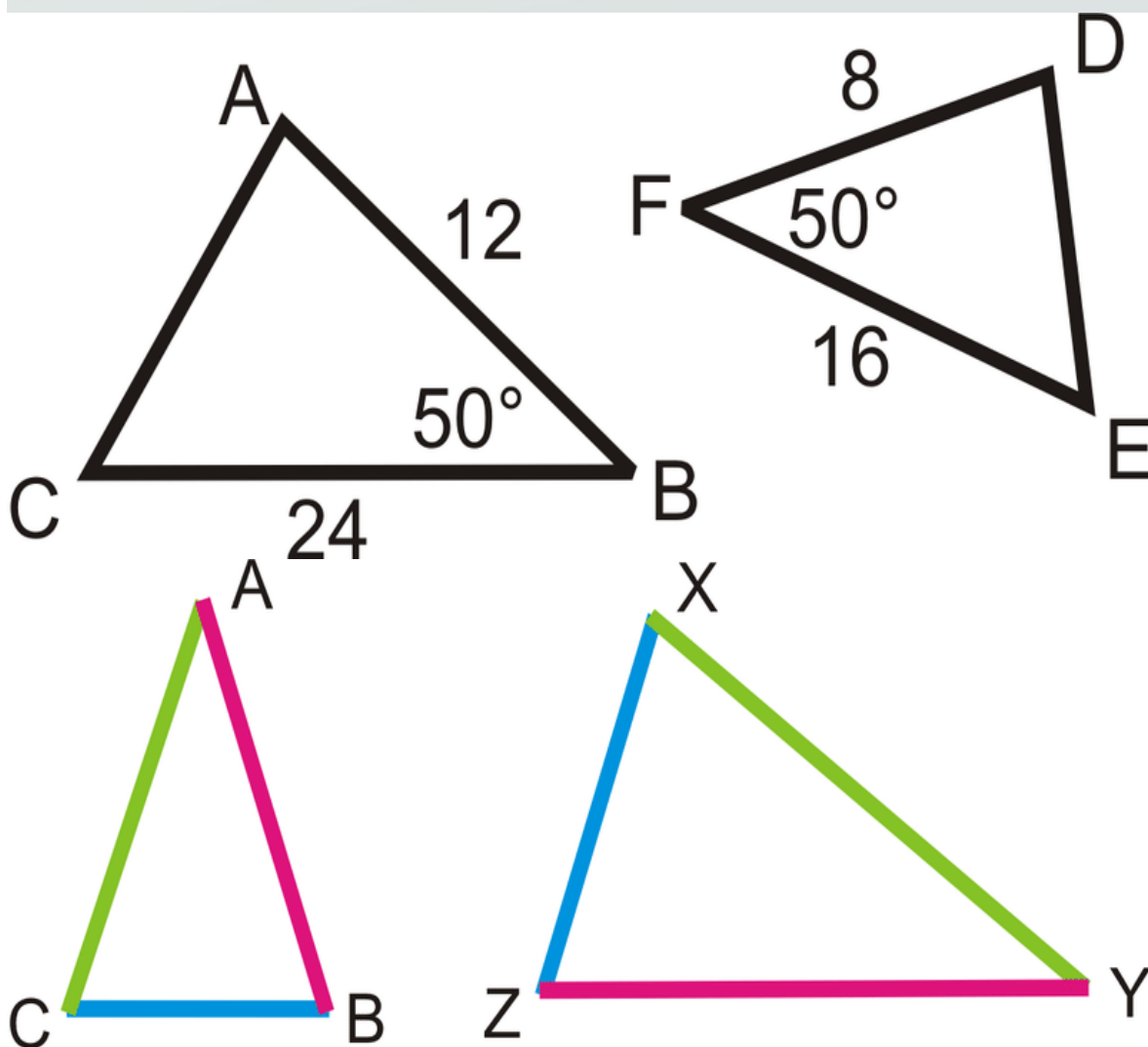- ସମ୍ବନ୍ଧିତ ପାର୍ଶ୍ୱଗୁଡ଼ିକ ଏକେ ଅନୁପାତରେ ରହେ

2. CRITERIA FOR SIMILARITY
Conditions of Similarity | ସଦୃଶତାର ନିୟମ

A

4 cm 104° 6 cm

47° 29°

C 8 cm B

D

8 cm 104° 12 cm

47° 29°

F 16 cm E

$$AB / DE = BC / EF = AC / DF$$

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A

12

50°

C 24 B

8 D

F 50°

16

E

A X

C B Z Y

(A) AA Similarity Theorem
Angle–Angle Similarity | କୋଣ–କୋଣ ସଦୃଶତା
Statement (English)

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

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ଯଦି ଦୁଇଟି ତ୍ରିଭୁଜର ଦୁଇଟି କୋଣ ସମାନ ହୁଏ, ତେବେ ସେମାନେ ସଦୃଶ।

Example
If $\angle A = \angle D$ and $\angle B = \angle E$
$\Rightarrow \Delta ABC \sim \Delta DEF$

(B) SAS Similarity Theorem
Side–Angle–Side Similarity | ପାର୍ଶ୍ୱ–କୋଣ–ପାର୍ଶ୍ୱ

Statement

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

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ଦୁଇଟି ପାର୍ଶ୍ୱର ଅନୁପାତ ସମାନ ଏବଂ ମଧ୍ୟବର୍ତ୍ତୀ କୋଣ ସମାନ ହେଲେ, ତ୍ରିଭୁଜ ସଦୃଶ।

(C) SSS Similarity Theorem
Side–Side–Side Similarity | ପାର୍ଶ୍ୱ–ପାର୍ଶ୍ୱ–ପାର୍ଶ୍ୱ
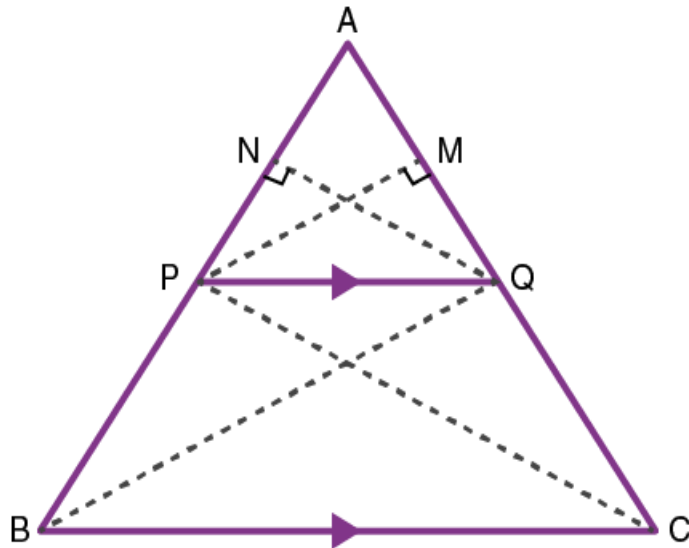### Statement

If corresponding sides of two triangles are proportional, then the triangles are similar.
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ତିନୋଟି ସମ୍ଭିତ ପାର୍ଶ୍ୱର ଅନୁପାତ ସମାନ ହେଲେ, ତ୍ରିଭୁଜ ସଦୃଶ।

3. BASIC PROPORTIONALITY THEOREM (BPT)
Thales Theorem | ଥେଲସ ନିୟମ
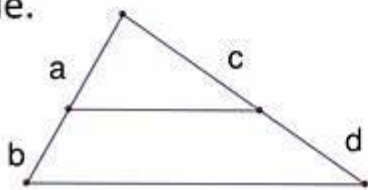
Parallel/Proportionality Conjecture

If a line parallel to one side of a triangle passes through the other two sides, then it divides the other two sides proportionally. (This ratio is not the scale factor between the triangles)

Conversely, if a line cuts two sides of a triangle proportionally, then it is parallel to the third side.

Assume line is parallel to base of triangle

$$\frac{a}{b} = \frac{c}{d}$$

Statement (English)

If a line is drawn parallel to one side of a triangle, it divides the other two sides in the same ratio.
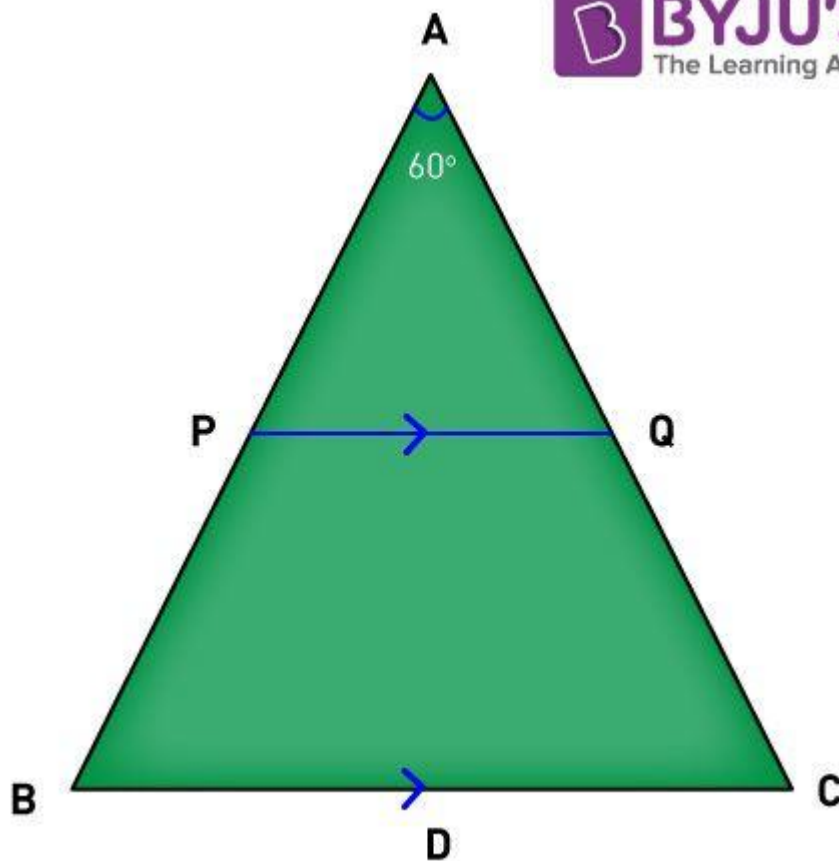
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ଯଦି ତ୍ରିଭୁଜର ଗୋଟିଏ ପାର୍ଶ୍ୱ ସହ ସମାନ୍ତର ରେଖା ଅନ୍ୟ ଦୁଇ ପାର୍ଶ୍ୱକୁ କାଟେ, ତେବେ ସେମାନେ ସମାନ ଅନୁପାତରେ ବିଭକ୍ତ ହୁଅନ୍ତି।
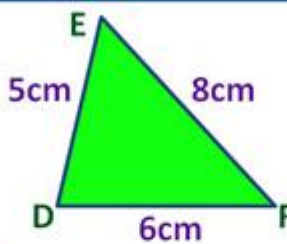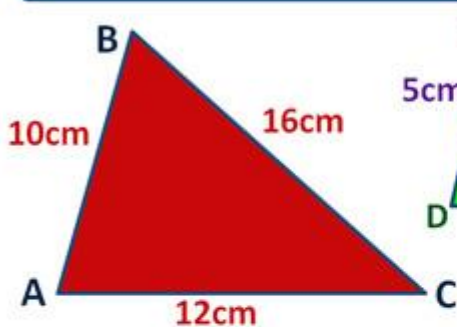
Result
ADDB=AEEC\frac{AD}{DB} = \frac{AE}{EC}DBAD=ECAE

4. AREAS OF SIMILAR TRIANGLES
Area Relation | କ୍ଷେତ୍ରଫଳ ସମ୍ପର୍କ

Similar Triangles – PPP / SSS

These two Triangles are SIMILAR, because their three Sides are all Proportional.

(Eg. When we calculate for the matching sides, they all give the same Scale Factor.)

$$\frac{AB}{DE} = \frac{10}{5} = 2$$

$$\frac{BC}{EF} = \frac{16}{8} = 2$$

$$\frac{AC}{DF} = \frac{12}{6} = 2$$

The Ratios of the matching sides are all the same value. (S.F. = 2)
All Sides are Proportional to each other.
Triangles are Similar by PPP Rule.

△ABC ~ △DEF   (~ means similar to)

Formula

Area of △1Area of △2=(Side1Side2)2\frac{\text{Area of } \triangle 1}{\text{Area of

} \triangle 2} =
\left(\frac{\text{Side}_1}{\text{Side}_2}\right)^2Area of △2Area of △1=(Side2 Side1)2

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ସଦୃଶ ତ୍ରିଭୁଜର କ୍ଷେତ୍ରଫଳର ଅନୁପାତ =
(ସମ୍ବନ୍ଧିତ ପାର୍ଶ୍ୱର ଅନୁପାତ)²

Solved Example | ସମାଧାନ

Question
Ratio of sides = 3 : 5
Find area ratio.
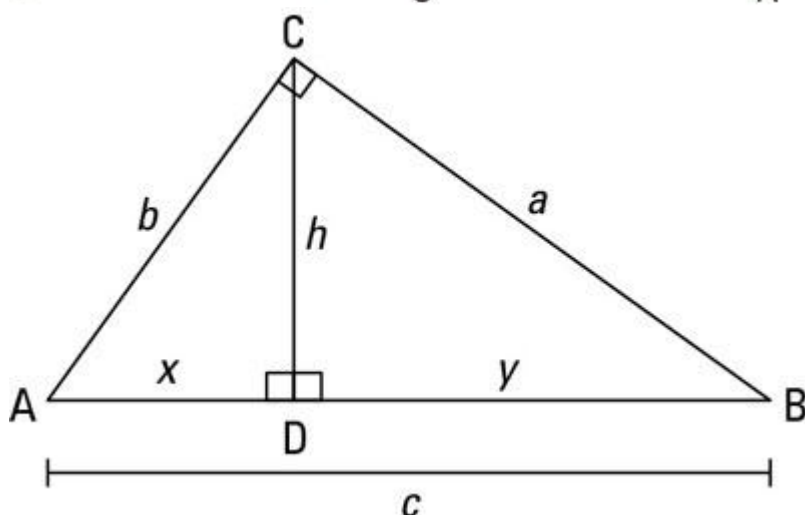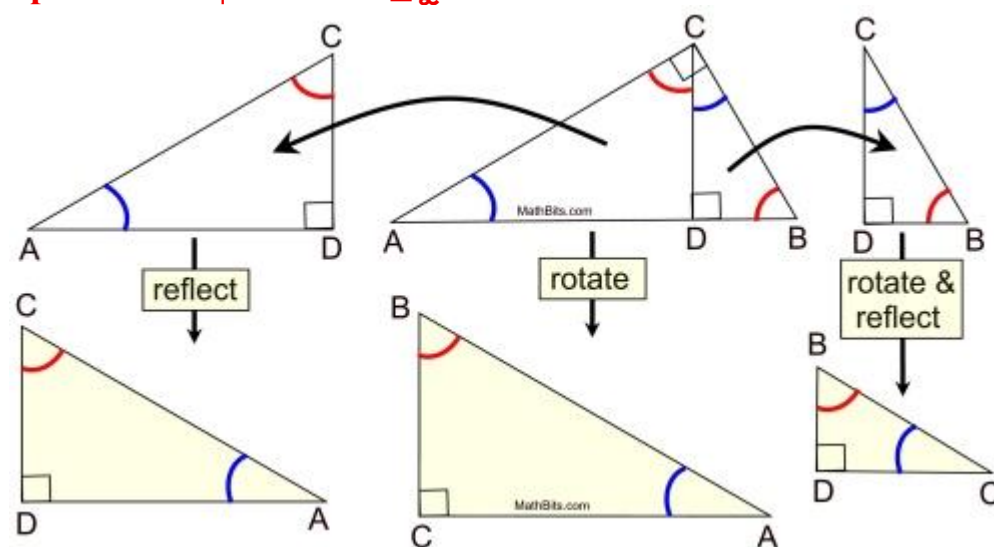### Solution
$(3:5)^2 = 9:25$ (3:5)2=9:25
Answer | ଉତ୍ତର: 9 : 25

5. RIGHT TRIANGLE & SIMILARITY
Special Case | ସମକୋଣ ତ୍ରିଭୁଜ

Statement

In a right triangle, the perpendicular drawn from the right angle to the hypotenuse divides the triangle into two smaller triangles which are similar to the original triangle.
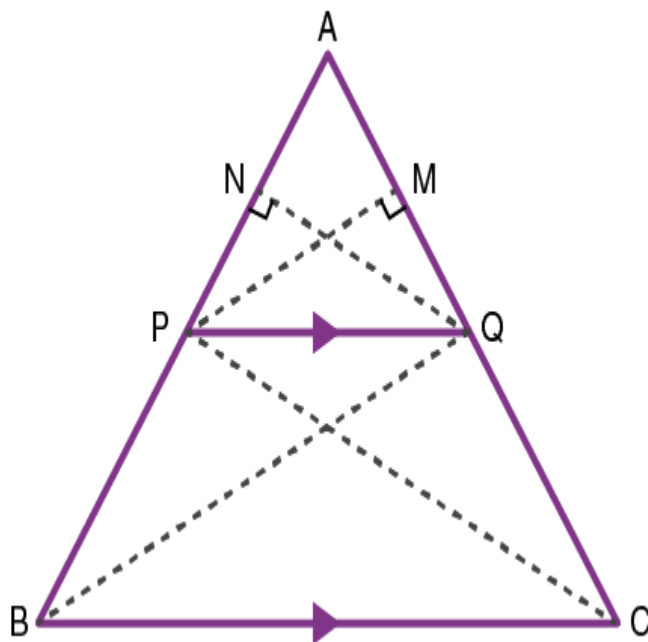
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ସମକୋଣ ତ୍ରିଭୁଜର କର୍ଣ୍ଣ ଉପରେ ଆଙ୍କା ଲମ୍ବ ଦ୍ୱାରା ଗଠିତ ଦୁଇ ତ୍ରିଭୁଜ ମୂଳ ତ୍ରିଭୁଜ ସହ ସଦୃଶ।

Basic Proportionality Theorem (BPT)

ଥେଲସ୍ ସିଦ୍ଧାନ୍ତ

TRIANGLE PROPORTIONALITY THEOREM

$$\frac{DA}{BD} = \frac{EC}{BE}$$

$$\frac{BD}{DA} = \frac{BE}{EC}$$
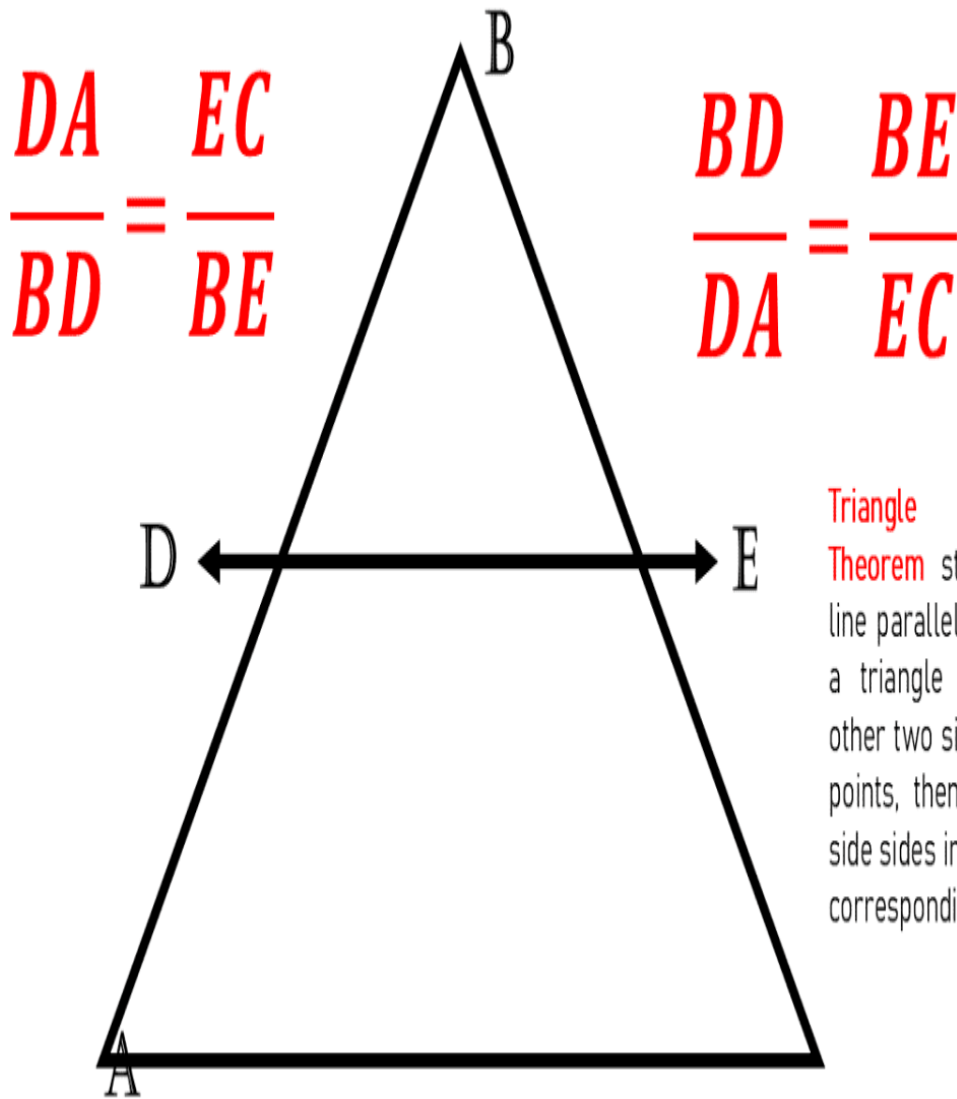
Triangle Proportionality Theorem states that If a line parallel to one side of a triangle intersects the other two sides in different points, then it divides the side sides into proportional corresponding segments.
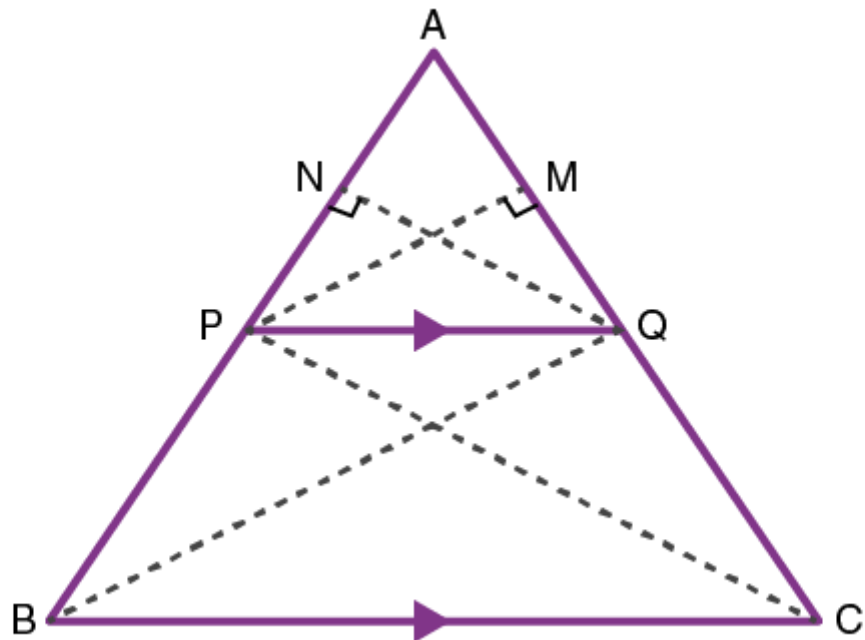
STATEMENT (English)

If a line is drawn parallel to one side of a triangle to intersect the other two sides, then it divides those sides in the same ratio.

ବକ୍ତବ୍ୟ (ଓଡ଼ିଆ)

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PREVIOUS-YEAR BOARD QUESTION (5 MARKS)

Question (English)

In ∆ABC, a line DE is drawn parallel to BC intersecting AB and AC in D and E respectively.
Prove that

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

ପ୍ରଶ୍ନ (ଓଡ଼ିଆ)

∆ABC ରେ DE, BC ସହ ସମାନ୍ତର।
D ଓ E ବିନ୍ଦୁ AB ଓ AC ଉପରେ ଅବସ୍ଥିତ।
ପ୍ରମାଣ କର—

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

PROOF / ପ୍ରମାଣ (BOARD-PERFECT)

Construction / ନିର୍ମାଣ

DE ∥ BC, D ∈ AB, E ∈ AC

Proof (English)

Since DE ∥ BC,
∠ADE = ∠ABC (Corresponding angles)
∠AED = ∠ACB (Corresponding angles)

Therefore,
ΔADE ~ ΔABC (By AA similarity)

⇒ADAB=AEAC\Rightarrow \frac{AD}{AB}=\frac{AE}{AC}⇒ABAD=ACAE
⇒ADDB=AEEC\Rightarrow \frac{AD}{DB}=\frac{AE}{EC}⇒DBAD=ECAE

Hence proved.

ପ୍ରମାଣ (ଓଡ଼ିଆ)

DE ∥ BC ଥିବାରୁ,
∠ADE = ∠ABC (ସମ୍ବନ୍ଧିତ କୋଣ)
∠AED = ∠ACB (ସମ୍ବନ୍ଧିତ କୋଣ)

ଏହେତୁ,
ΔADE ~ ΔABC (AA ସଦୃଶତା)

⇒ADAB=AEAC\Rightarrow \frac{AD}{AB}=\frac{AE}{AC}⇒ABAD=ACAE
⇒ADDB=AEEC\Rightarrow \frac{AD}{DB}=\frac{AE}{EC}⇒DBAD=ECAE

ଏହା ପ୍ରମାଣିତ ।

MARKING SCHEME (5 MARKS)

Step	Marks
Diagram	1
Angle relation	1
Similarity statement	1
Ratio derivation	1
Conclusion	1

PREVIOUS-YEAR NUMERICAL (BPT APPLICATION – 5 MARKS)

Question (English)

In ∆ABC, DE ∥ BC.
AD = 3 cm, DB = 5 cm and AE = x cm, EC = 10 cm.
Find x.

ପ୍ରଶ୍ନ (ଓଡ଼ିଆ)

∆ABC ରେ DE ∥ BC।
AD = 3 ସେ.ମି., DB = 5 ସେ.ମି., AE = x ସେ.ମି., EC = 10 ସେ.ମି.
x ର ମୂଲ୍ୟ ନିର୍ଣ୍ଣୟ କର।

Solution / ସମାଧାନ

By BPT,

$\frac{AD}{DB}=\frac{AE}{EC}$
$\frac{3}{5}=\frac{x}{10}$
$x=\frac{3×10}{5}=6$

Answer / ଉତ୍ତର: x = 6 cm

JAI HIND! BINAYA