UDAAN

2025

Triangles

Mathematics | **Lecture - 02**

By – Ritik Sir

Topics *to be covered*

1. Basic Proportionality Theorem **(Thales Theorem)**
2. Converse of Basic Proportionality Theorem


WORK HARD
DREAM BIG
NEVER GIVE UP !!

Kese Rahe mid-term Exams?

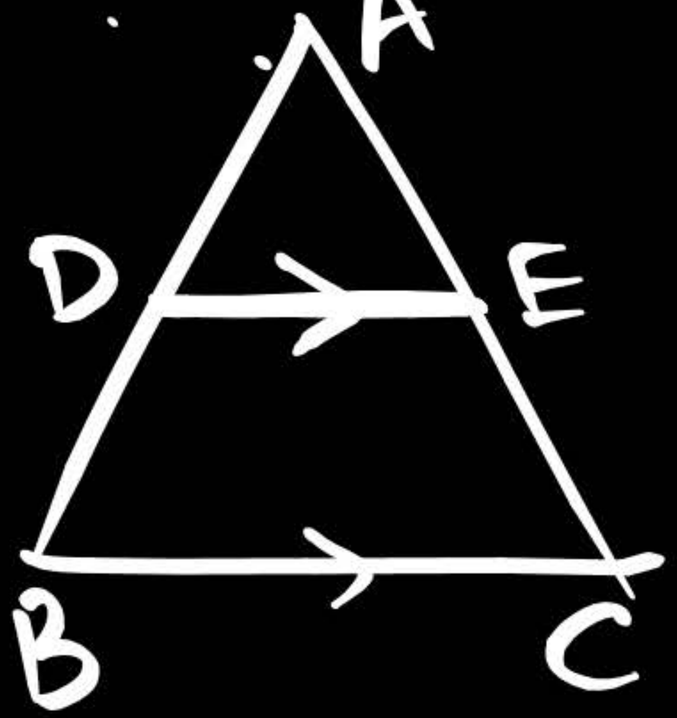
A) B.B 32%

B) B. Bekar 25%

C) hue nahi 36%

D) Aayein... 5%. .

B.P.T



If, DE || BC

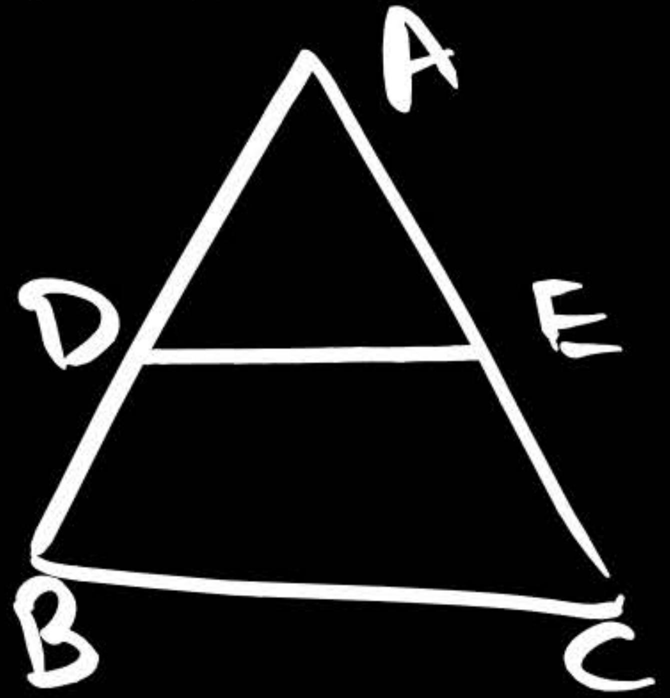
then, $\frac{AD}{DB} = \frac{AE}{EC}$ ①

$\frac{AD}{AB} = \frac{AE}{AC}$ ②

$\frac{DB}{AB} = \frac{EC}{AC}$ ③

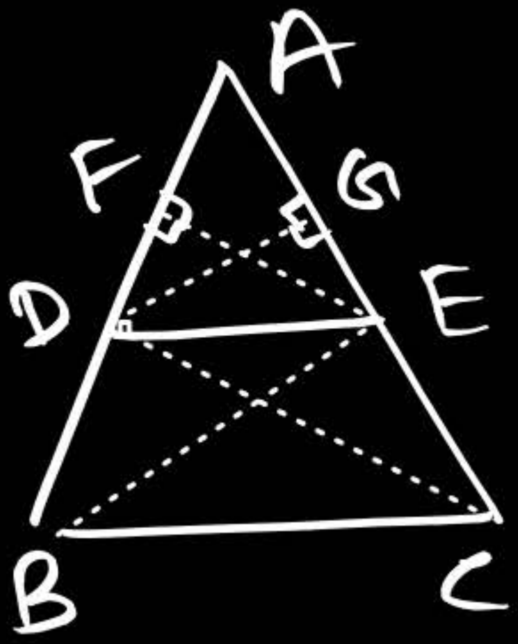
Proof already done.

Conversion of B.P.T



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

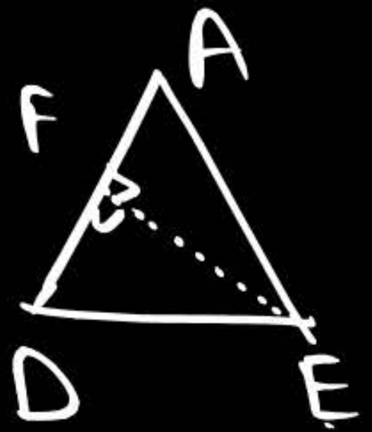
then, $\boxed{DE \parallel BC.}$



G: $DE \parallel BC$

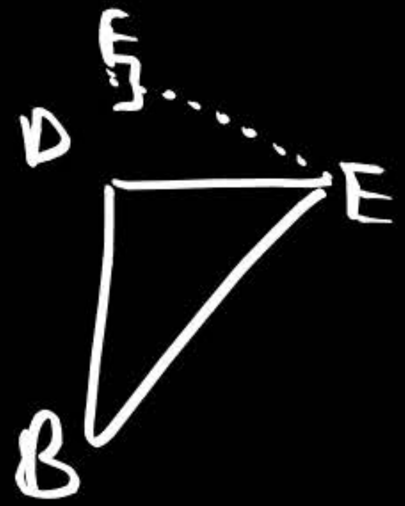
To p: $\dfrac{AD}{DB} = \dfrac{AE}{EC}$

Const: $EF \perp AD$, $DG \perp AE$



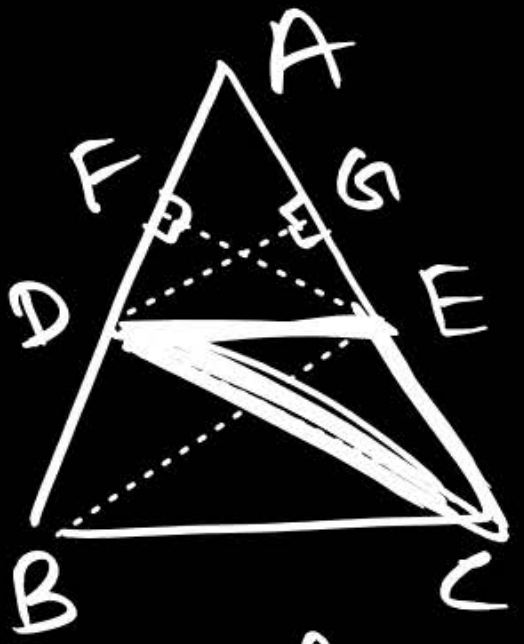
$A \cdot \Delta ADE = \frac{1}{2} \times AD \times EF$ — (1)

$A \cdot \Delta BDE = \frac{1}{2} \times DB \times EF$ — (2)



(1) ÷ (2)

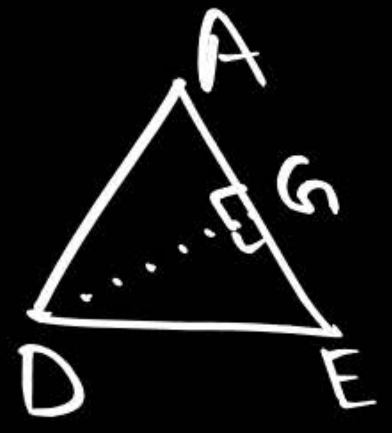
$$\boxed{\frac{A \cdot \Delta ADE}{A \cdot \Delta BDE} = \frac{AD}{DB}}$$ — (3)



G: $DE \parallel BC$

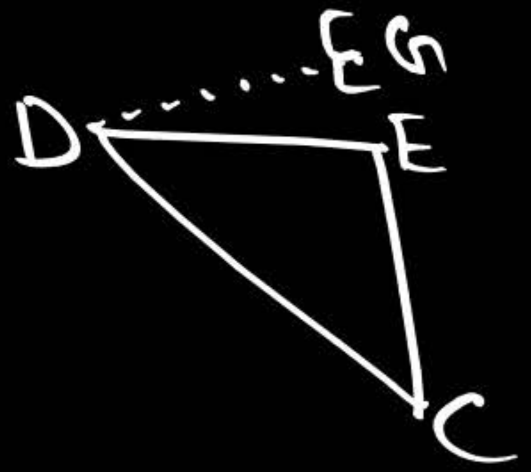
To p: $\frac{AD}{DB} = \frac{AE}{EC}$

Const: $EF \perp AD$, $DG \perp AE$



$A \cdot \Delta ADE = \frac{1}{2} \times AE \times DG$ — (4)

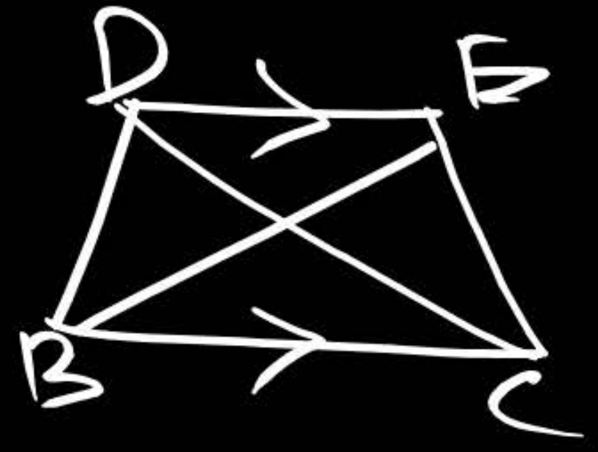
$A \cdot \Delta DEC = \frac{1}{2} \times EC \times DG$ — (5)



(4) ÷ (5)

$$\boxed{\frac{A \cdot \Delta ADE}{A \cdot \Delta DEC} = \frac{AE}{EC}} \quad (6)$$

$$\boxed{\frac{A \cdot \Delta ADE}{A \cdot \Delta BDE} = \frac{AD}{DB}} \quad (3)$$



Triangles on the same base and b/w same parallels are equal in area

$\therefore A \cdot \Delta DEC = A \cdot \Delta DEB$

Now from eqn (6) and (7)

$$\frac{A \cdot \Delta ADE}{A \cdot \Delta DEC} = \frac{A \cdot \Delta ADE}{A \cdot \Delta DEB}$$

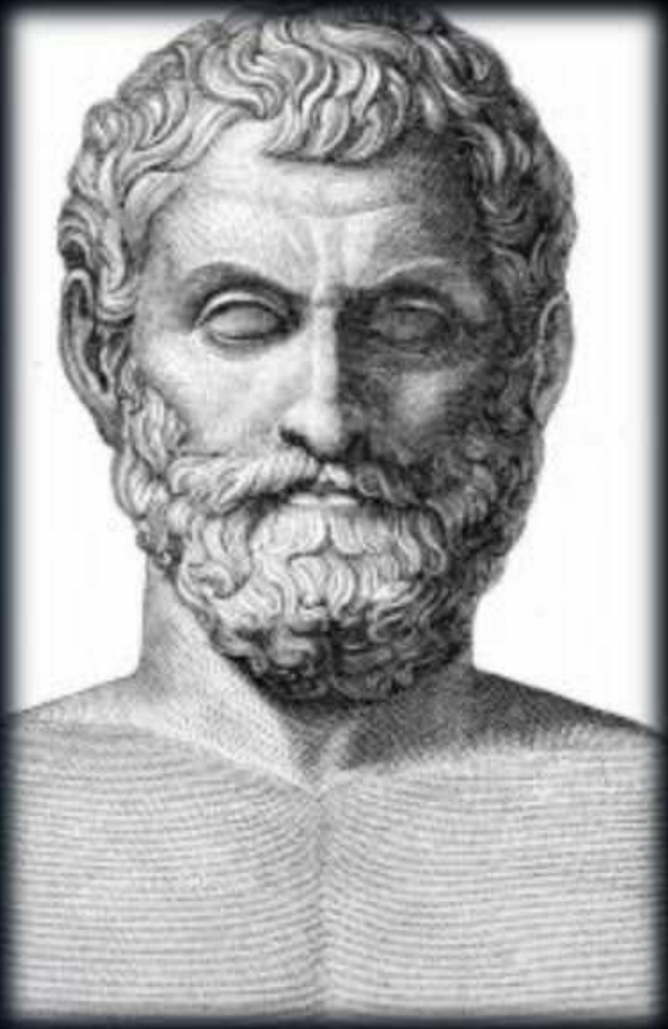
$$\boxed{\frac{AE}{EC} = \frac{AD}{DB}}$$

H.P

Topic : Theorem 1

(Basic Proportionality Theorem or Thales Theorem)

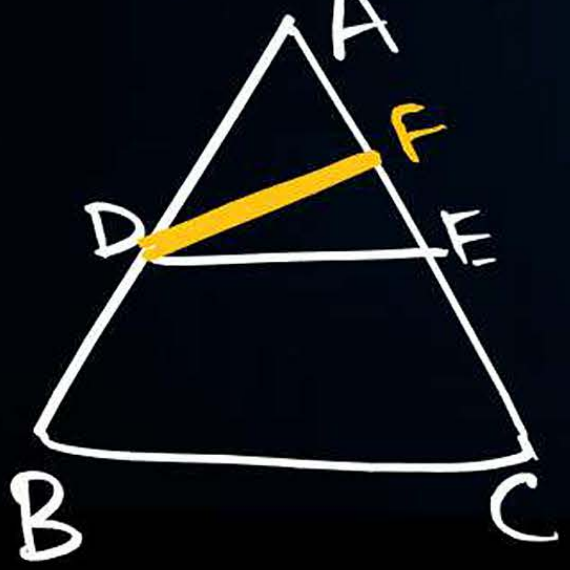
If a line a drawn parallel to one side of a triangle intersecting the other two sides, then it is divides the two sides in the same ratio.



Topic : Theorem 2

(Converse of Basic Proportionality Theorem)

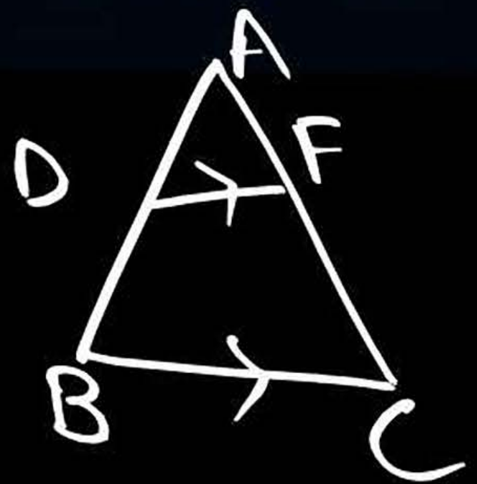
If a line divides any two sides of a tringle in the same ratio, then the line must be product to the third side.



G: $\boxed{\frac{AD}{DB} = \frac{AE}{EC}}$ — 1

To p: DE || BC.

Proof: let DF || BC.



By B.P.T..

$\boxed{\frac{AD}{DB} = \frac{AF}{FC}}$ — 2

From 1 and 2

$$\boxed{\frac{AE}{EC} = \frac{AF}{FC}}$$

$$\frac{AE}{EC} + 1 = \frac{AF}{FC} + 1$$

$$\frac{AE + EC}{EC} = \frac{AF + FC}{FC}$$

$$\frac{\cancel{AC}}{EC} = \frac{\cancel{AC}}{FC}$$

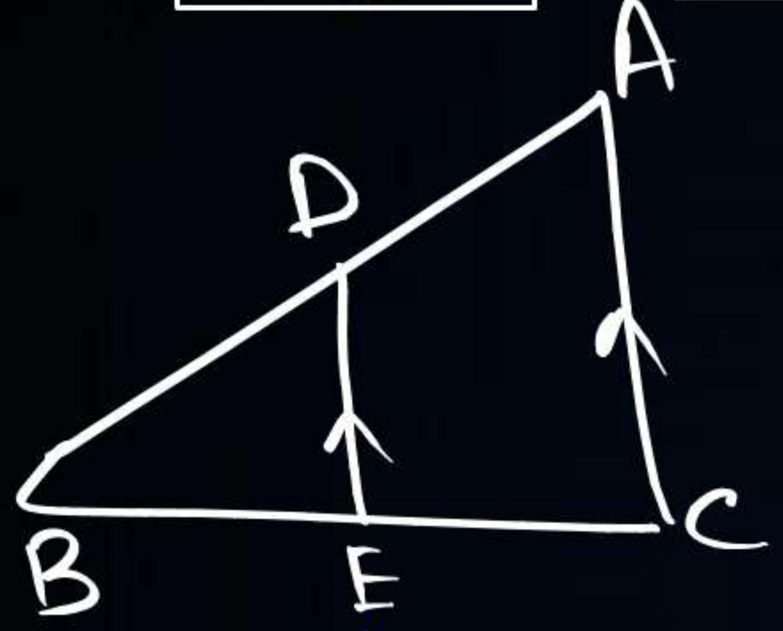
FC = EC

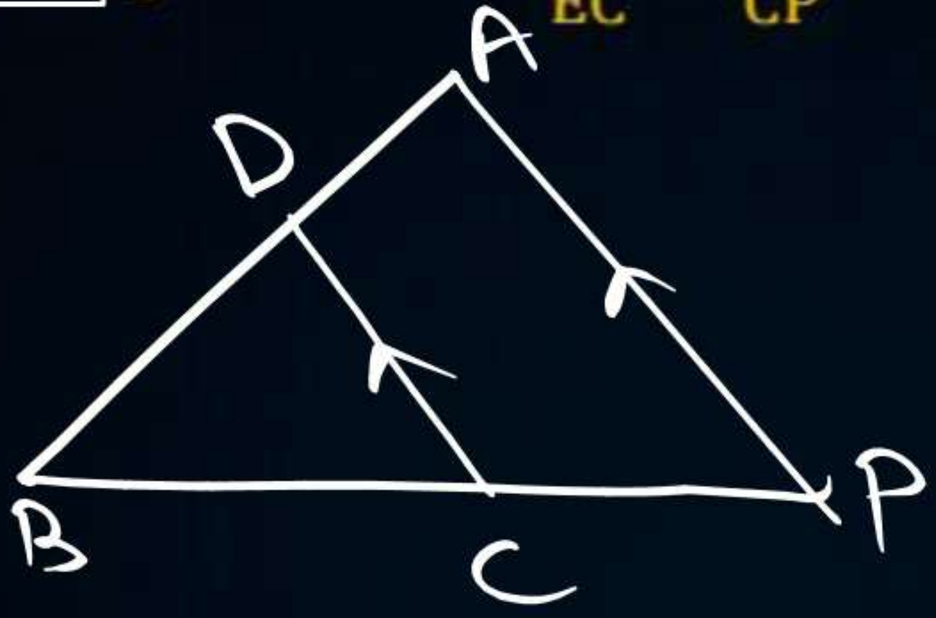
This means 'E' and 'F' coincides.

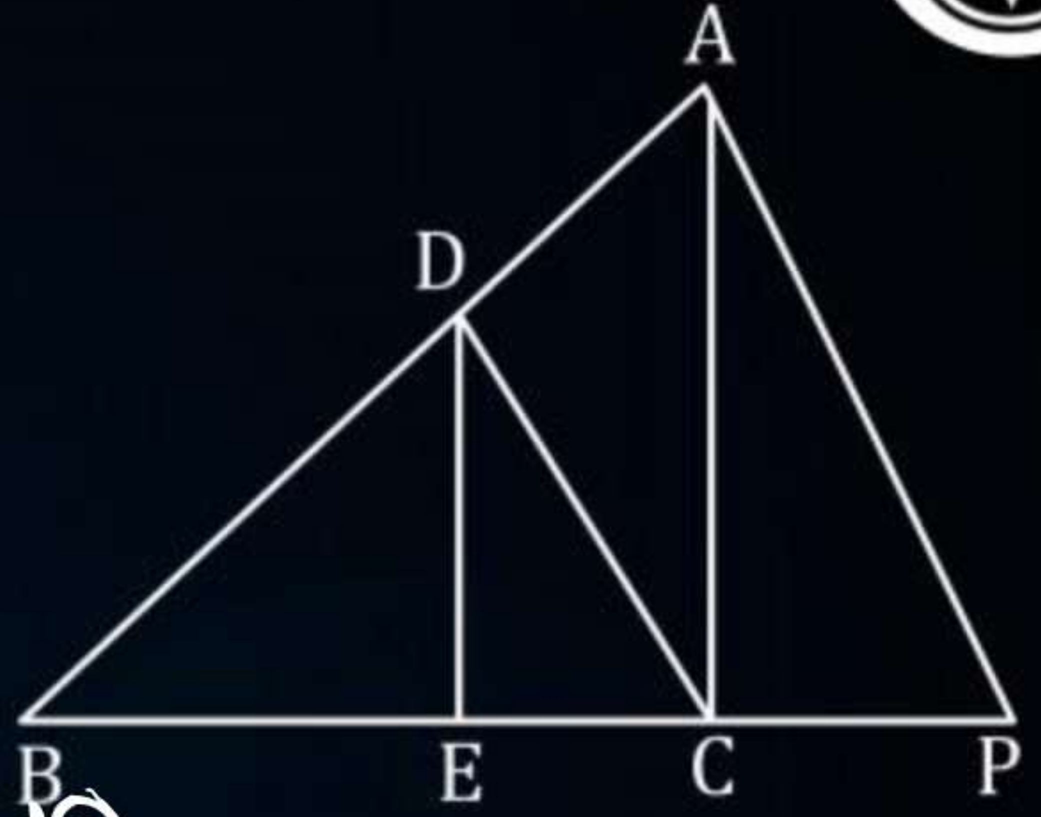
$\therefore$ DE || BC

Topic : BPT

#Q. $\boxed{DE \parallel AC}$ and $\boxed{DC \parallel AP}$, prove that $\frac{BE}{EC} = \frac{BC}{CP}$







By B.P.T

$\boxed{\frac{BE}{EC} = \frac{BD}{DA}}$ — (1)

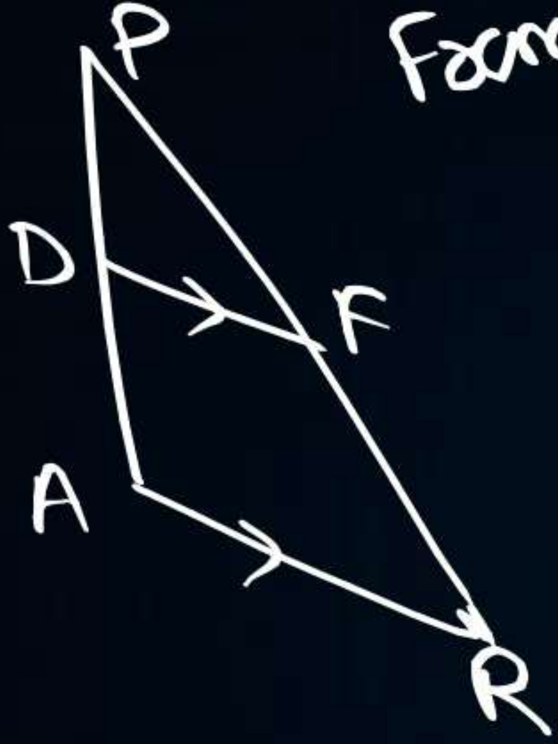
$\boxed{\frac{BC}{CP} = \frac{BD}{DA}}$ — (2)

From (1) and (2)

$\boxed{\frac{BE}{EC} = \frac{BC}{CP}}$ //

Topic : BPT

#Q. $\boxed{DE \parallel AQ}$ and DF || AR. Prove that EF || QR. [NCERT, CBSE 2008]



$$\boxed{\frac{PE}{EQ} = \frac{PD}{DA}} \quad - (1)$$

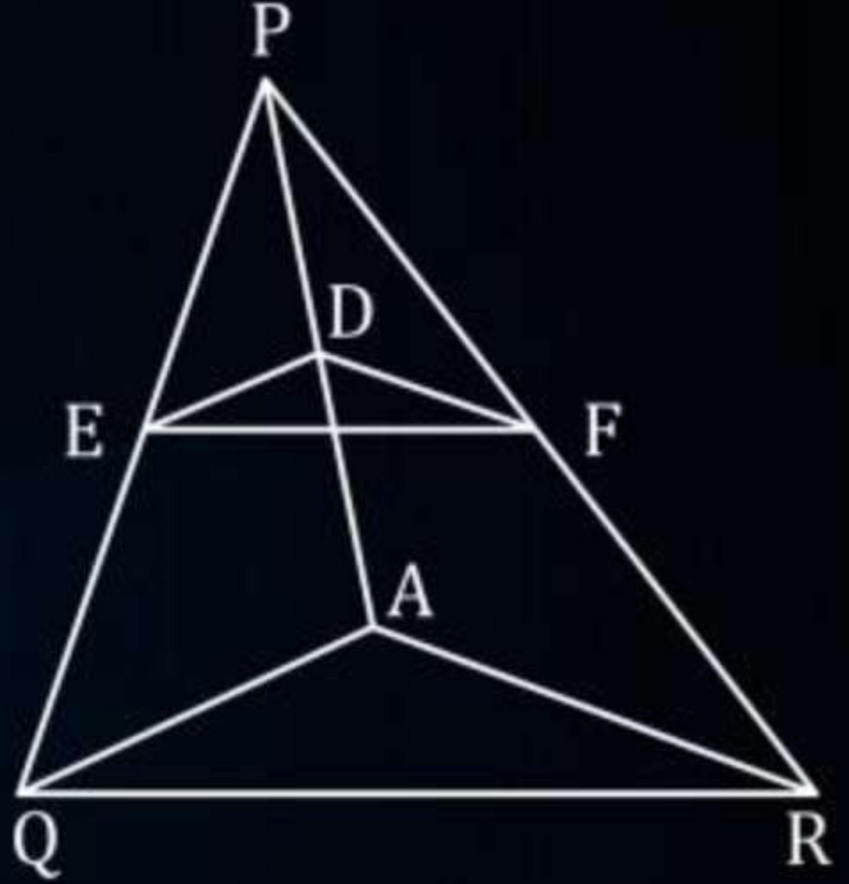
$$\boxed{\frac{PD}{DA} = \frac{PF}{FR}} \quad - (2)$$

From, (1) and (2)

$$\frac{PE}{EQ} = \frac{PF}{FR}$$

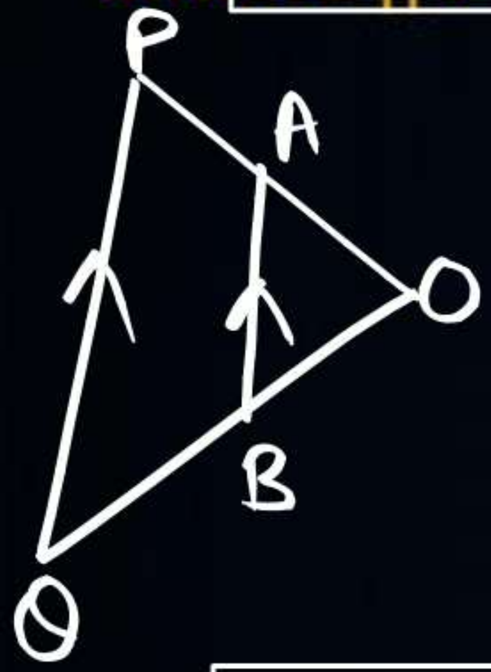
By converse of B.P.T,

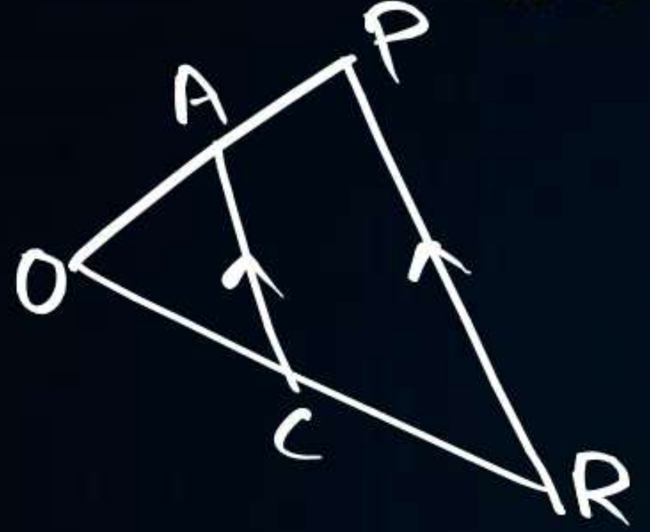
EF || QR



Topic : BPT

#Q. In fig. A, B and C are points on OP, OQ and OR respectively such that AB || PQ and AC || PR. Show that BC || QR.





$$\boxed{\frac{OA}{AP} = \frac{OB}{BQ}} \quad -(1)$$

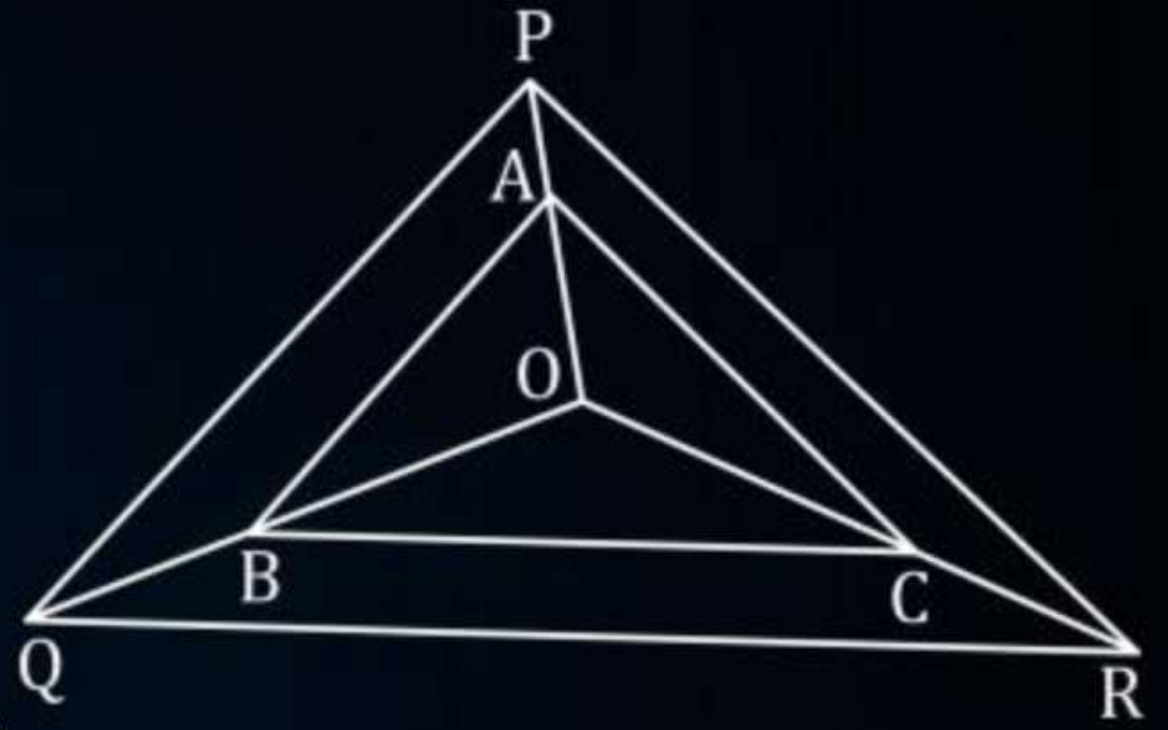
$$\boxed{\frac{OA}{AP} = \frac{OC}{CR}} \quad -(2)$$

From (1) and (2)

$$\boxed{\frac{OB}{BQ} = \frac{OC}{CR}}$$

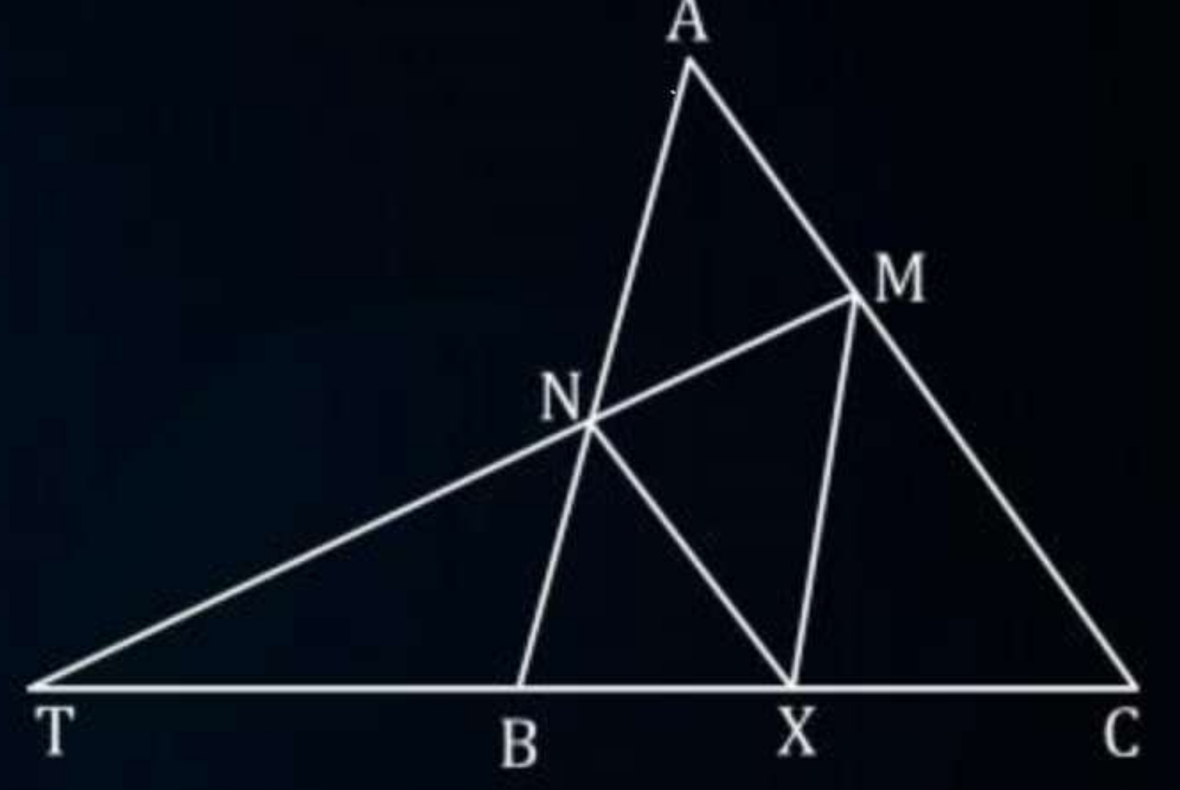
By converse of B.P.T

BC || QR



Topic : BPT

#Q. Let X be any point on the side BC of a triangle ABC. If XM, XN are drawn parallel to BA and CA meeting CA, BA in M, N respectively; MN meets BC produced in T, prove that $TX^2 = TB \times TC$.

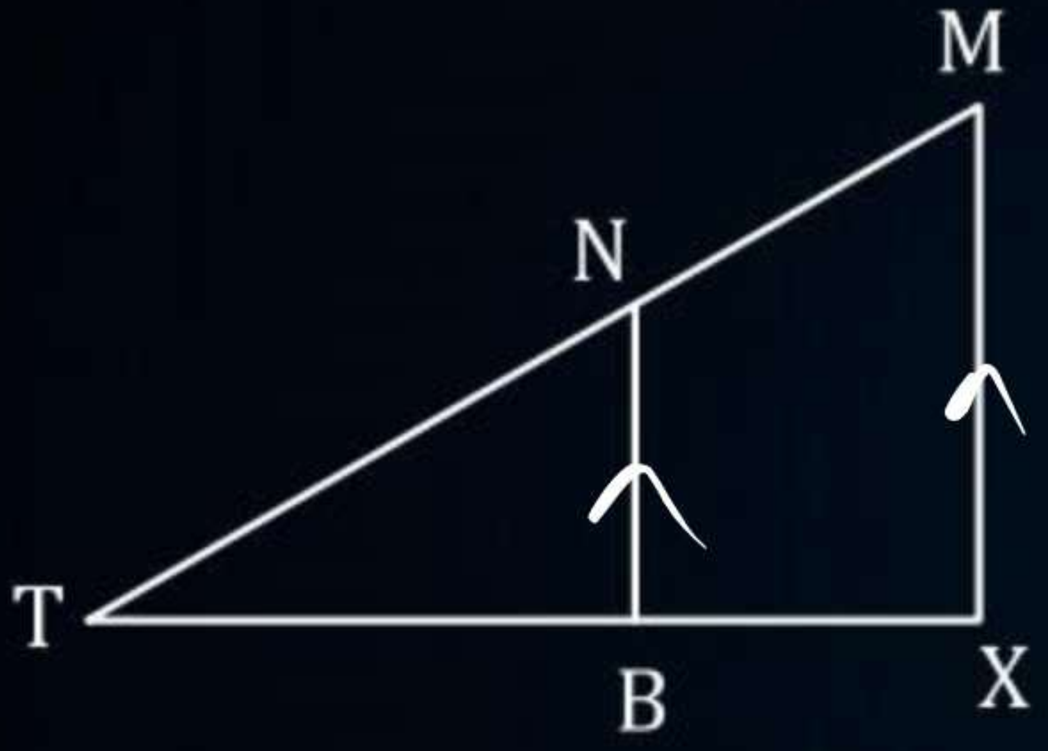


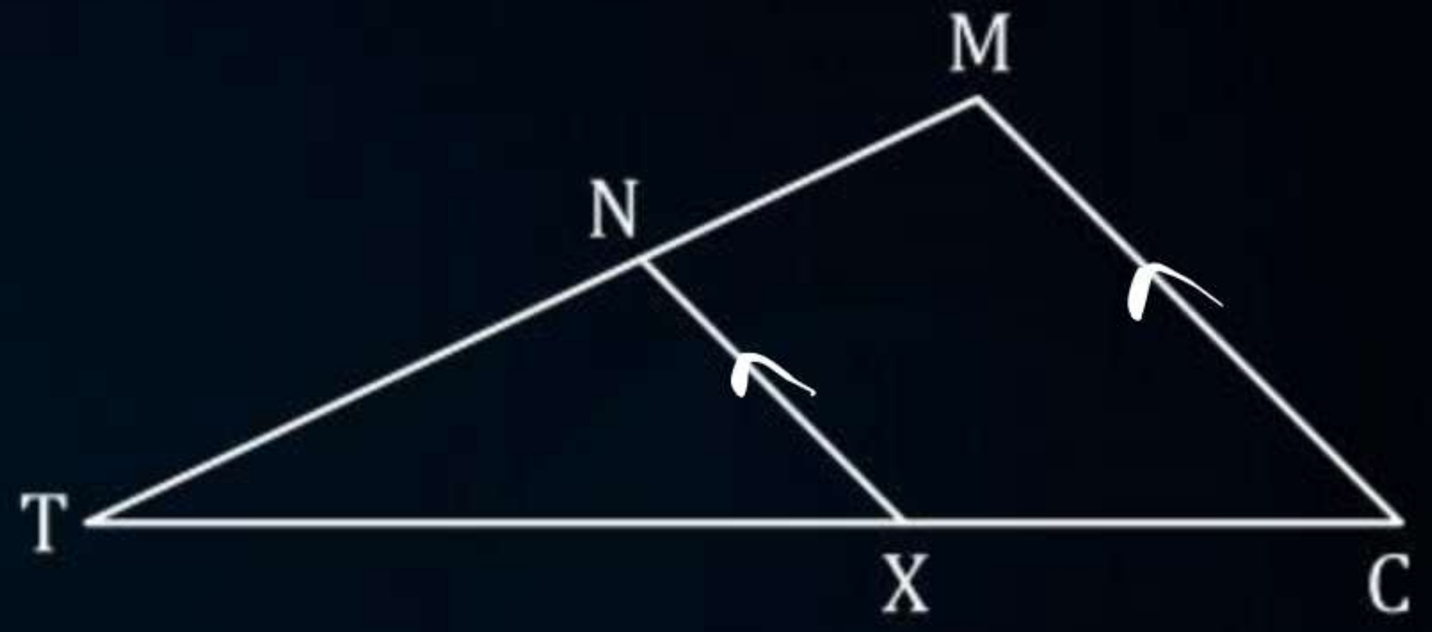
$XN \parallel CA$

$\Rightarrow XN \parallel CM$

$XM \parallel BA$

$\Rightarrow XM \parallel BN$





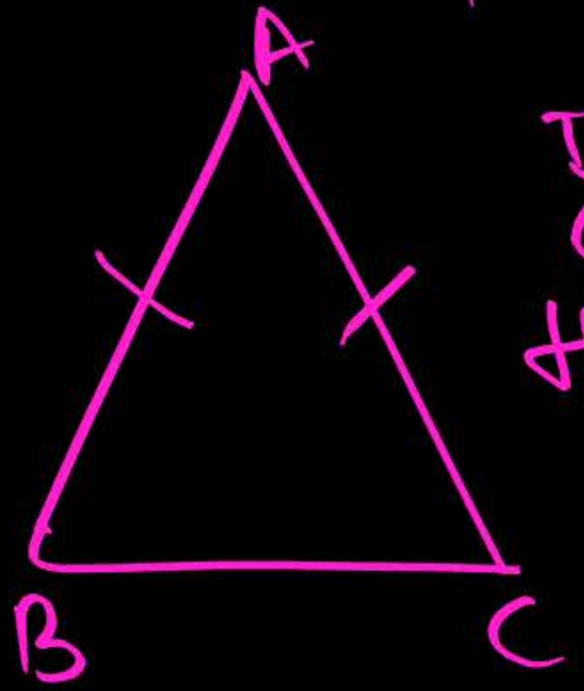
$$\boxed{\frac{TB}{TX} = \frac{TN}{TM}} \quad \text{---} (1)$$

$$\boxed{\frac{TX}{TC} = \frac{TN}{TM}} \quad \text{---} (2)$$

$$\frac{TB}{TX} = \frac{TX}{TC}$$

$$\boxed{TB \cdot TC = TX^2}$$

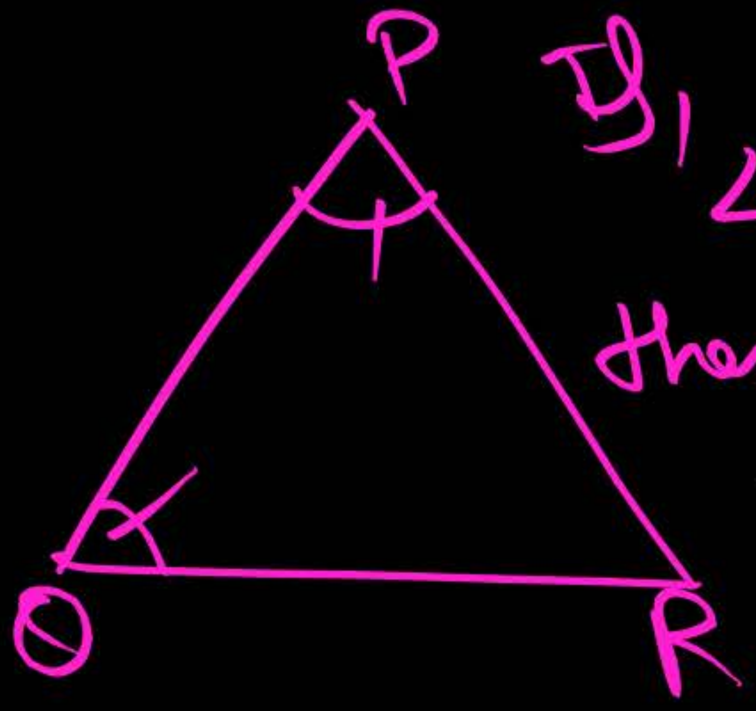
Important Concept.



If, $AB = AC$

then, $\angle C = \angle B$

Angles opp. to equal sides.



If, $\angle P = \angle Q$

then $QR = PR$

Sides opp. to equal angles.

Topic : BPT

#Q. $\frac{PS}{SQ} = \frac{PT}{TR}$ and $\angle PST = \angle PRQ$. Prove that ΔPQR is an isosceles. [NCERT]

G:

Top:

By 'C' of B.P.T

ST || QR

let, $\angle PST = \angle PRQ = x$.

Since ST || QR

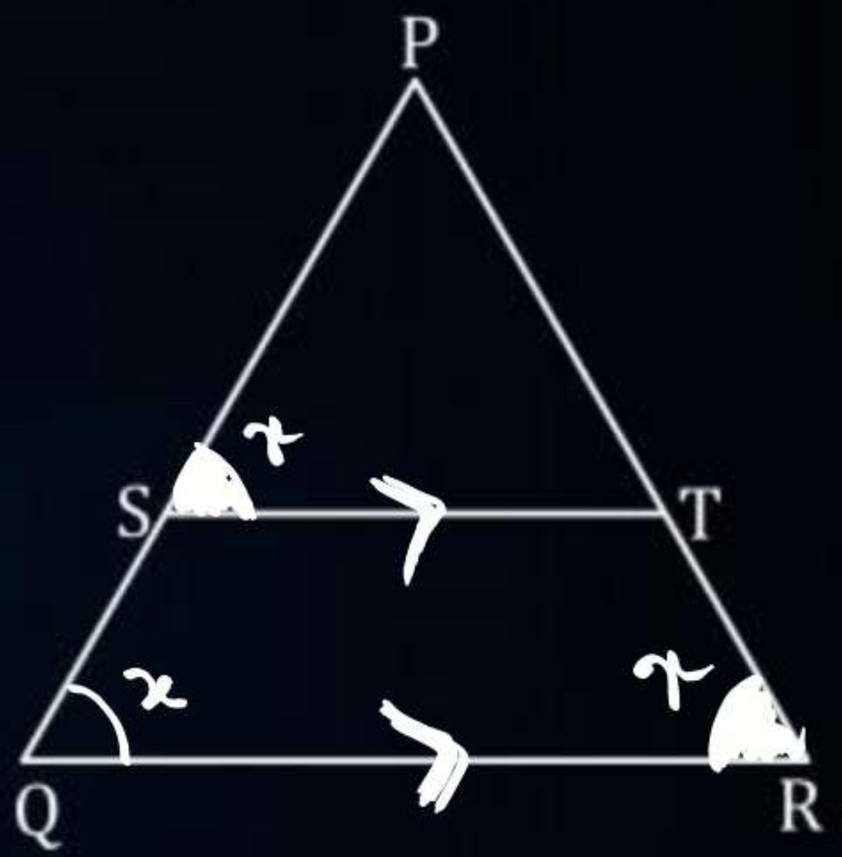
$\therefore \angle PST = \angle PQR = x$

(corresponding $\angle$'s)

$\Rightarrow \angle PQR = \angle PRQ$

PR = PQ — sides opp. to equal angles.

(Hence Δ is isosceles)

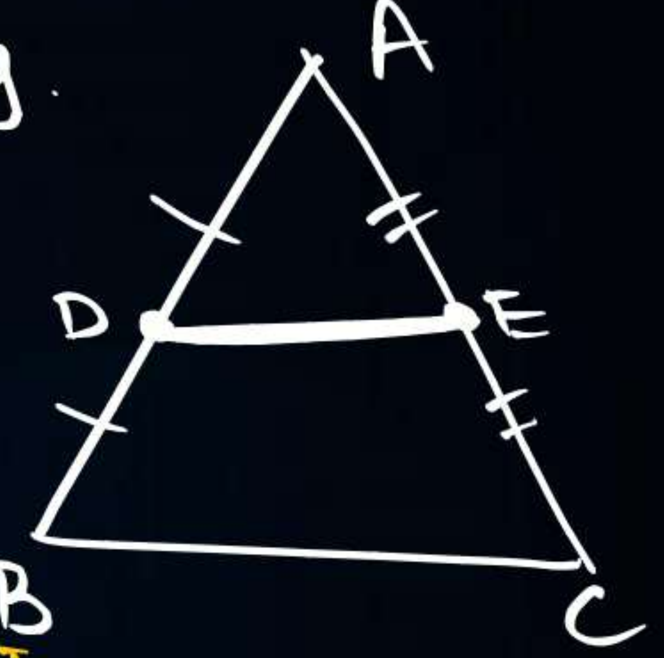


Topic : BPT

#Q. [redacted] prove that the line joining the mid-points of any two sides of a triangle is parallel - to the third side. (Recall that you have done it in

G: D and E are mid. points of AB and AC respectively.

To p: $DE \parallel BC$.



Proof: D mid point of AB

$\Rightarrow AD = DB \times 1$

$\boxed{\frac{AD}{DB} = 1}$ —(1)

E mid. point of AC

$AE = EC \times 1$

$\boxed{\frac{AE}{EC} = 1}$ —(2)

From 1 & 2

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

By 'C' of B.P.T

$\boxed{DE \parallel BC}$

Topic : BPT

#Q. ABCD is a trapezium in which AB || DC and its diagonal intersect each other at the point O. Show that $\frac{AO}{BO} = \frac{CO}{DO}$.

G: $AB \parallel DC$

To p: $\frac{AO}{BO} = \frac{CO}{DO}$

Const: $EO \parallel DC$

Proof: $EO \parallel DC$

By B.P.T

$$\boxed{\frac{AE}{ED} = \frac{AO}{OC}} \quad (1)$$

Since $FO \parallel DC$

also, $AB \parallel DC$

$\Rightarrow EO \parallel AB$

By B.P.T

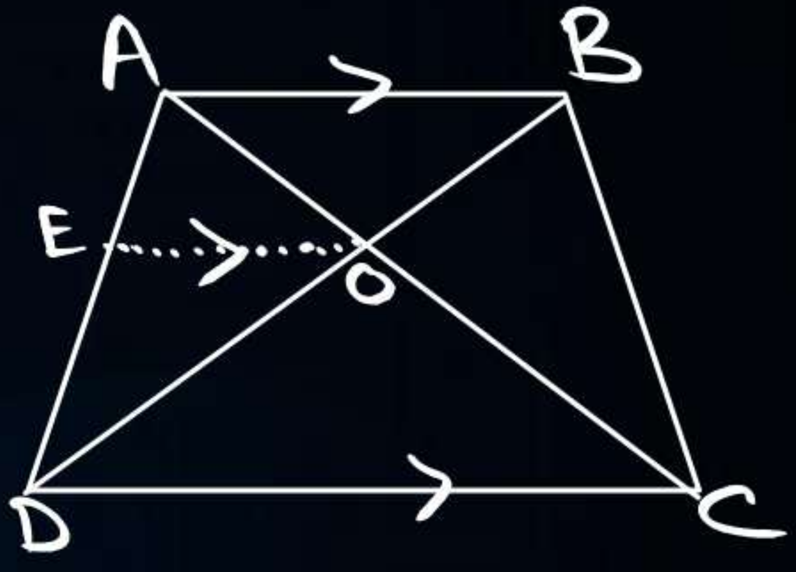
$$\boxed{\frac{AE}{ED} = \frac{OB}{OD}} \quad (2)$$

From (1) and (2)

$$\frac{OA}{OC} = \frac{OB}{OD}$$

$$\Rightarrow \boxed{\frac{OA}{OB} = \frac{OC}{OD}}$$

H.P.



Topic : BPT

AB || DC

#Q. The diagonals of a quadrilateral ABCD intersect each other at the point O such that $\frac{AO}{BO} = \frac{CO}{DO}$. ABCD is a trapezium.

G: $\frac{AO}{BO} = \frac{CO}{DO}$

$\boxed{\frac{AO}{OC} = \frac{OB}{OD}}$ — (2)

TOP: ABCD is a trapezium

Const: IO || DC — (3)

Proof: Since IO || DC

By B.P.T,

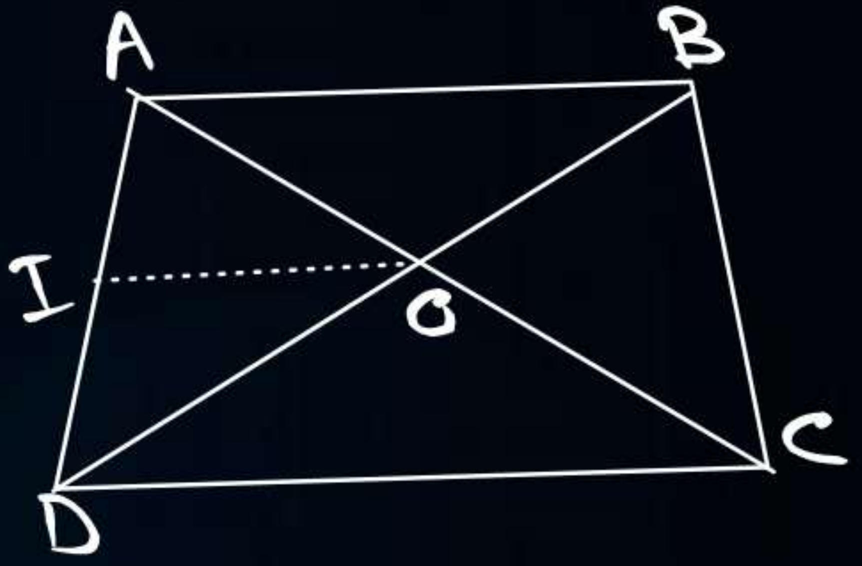
$\boxed{\frac{AI}{ID} = \frac{AO}{OC}}$ — (1)

From (1) and (2)

$\frac{AI}{ID} = \frac{OB}{OD}$

By 'C' of B.P.T

IO || AB — (4)



From (3) and (4)

$\boxed{AB \parallel DC}$

$\Rightarrow$ ABCD is a trapezium.

Topic : BPT

#Q. If D and E are points on side AB and AC respectively of a ΔABC such that $DE \parallel BC$ and $BD = CE$. Prove that ΔABC is isosceles. [CBSE 2007, 2009]

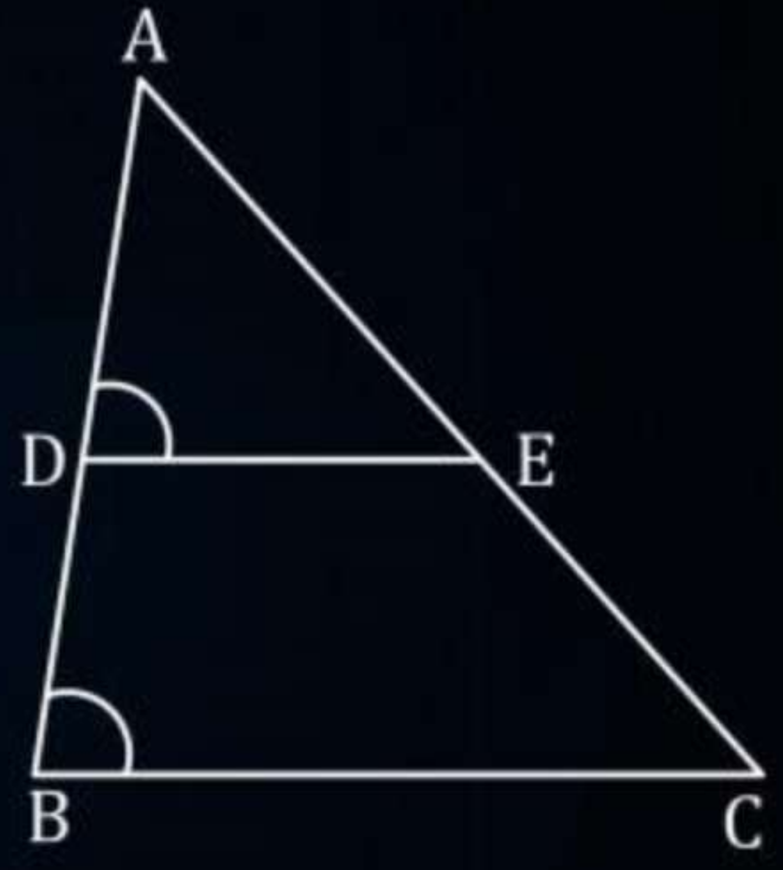
HW

+ DPP no. 1

Topic : BPT

#Q. In figure, If AD = 6 cm, DB = 9 cm, AE = 8 cm and EC = 12 cm and $\angle ADE = 48°$. Find $\angle ABC$.

[CBSE SQP, 2018-19]



Topic : BPT

#Q. ABCD is a parallelogram, P is a point on side BC and DP when produced meets AB produced at L. Prove that $\frac{DP}{PL} = \frac{DC}{BL}$.

THANK YOU