Padasalai's Telegram Groups!

(தலைப்பிற்கு கீழே உள்ள லிங்கை கிளிக் செய்து குழுவில் இணையவும்!)

- Padasalai's NEWS - Group

https://t.me/joinchat/NIfCqVRBNj9hhV4wu6_NqA

- Padasalai's Channel - Group

https://t.me/padasalaichannel

- Lesson Plan - Group

https://t.me/joinchat/NIfCqVWwo5iL-21gpzrXLw

- 12th Standard - Group

https://t.me/Padasalai_12th

- 11th Standard - Group

https://t.me/Padasalai_11th

- 10th Standard - Group

https://t.me/Padasalai_10th

- 9th Standard - Group

https://t.me/Padasalai_9th

- 6th to 8th Standard - Group

https://t.me/Padasalai_6to8

- 1st to 5th Standard - Group

https://t.me/Padasalai_1to5

- TET - Group

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- PGTRB - Group

https://t.me/Padasalai_PGTRB

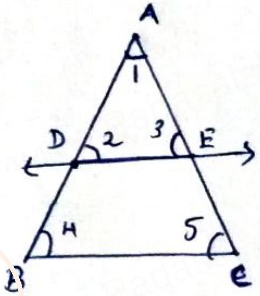
- TNPSC - Group

https://t.me/Padasalai_TNPSC

BASIC PROPORTIONALITY THEOREM (OR) THALES THEOREM.

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

Given: In ΔABC, D is a point on AB and E is a point on AC.



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

construction: Draw $DE \parallel BC$.

Proof:

$\angle 2 = \angle 4$ ($\because$ corresponding angles)

$\angle 3 = \angle 5$

$\therefore \Delta ABC \sim \Delta ADE$

$\frac{AB}{AD} = \frac{AC}{AE}$

$\frac{AD+BD}{AD} = \frac{AE+EC}{AE}$

$1 + \frac{BD}{AD} = 1 + \frac{EC}{AE}$

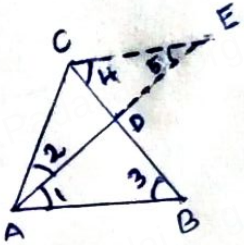
$\boxed{\frac{AD}{BD} = \frac{AE}{EC}}$

Hence proved.

ANGLE BISECTOR THEOREM

The internal bisector of an angle of a triangle divides the opposite side internally in the ratio of the corresponding sides containing the angle.

Given: In ΔABC, AD is the internal bisector.



To prove: $\frac{AB}{AC} = \frac{BD}{CD}$

Construction: Draw a line $CE \parallel AB$, Extend AD meet at E.

Proof: In ΔABD and ΔCDE

$\angle 1 = \angle 5$ (alternate angles)

$\angle 3 = \angle 4$

$\Delta ABD \sim \Delta CDE$

$\therefore \frac{AB}{CE} = \frac{BD}{CD} \rightarrow (1)$

$\angle 2 = \angle 5$ ($\because \angle 1 = \angle 2$)

$\therefore AC = CE$ (opposite sides to equal angles)

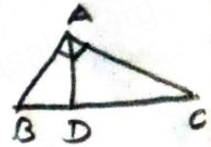
From (1)

$\frac{AB}{AC} = \frac{BD}{CD}$

Hence proved.

PYTHAGORAS THEOREM

In a right angle triangle, the square of the hypotenuse is equal to the sum of the squares of other two sides.



Given: ΔABC, $\angle A = 90°$

To prove: $BC^2 = AB^2 + AC^2$

construction: Draw $AD \perp BC$

Proof:

$\Delta ABC \sim \Delta ABD$ ($\because \angle B$ is common, $\angle A = \angle D = 90°$)

$\frac{BC}{AB} = \frac{AB}{BD}$

$AB^2 = BC \times BD$ — (1)

$\Delta ABC \sim \Delta ADC$ ($\because \angle C$ is common, $\angle A = \angle D = 90°$)

$\frac{BC}{AC} = \frac{AC}{DC}$

$AC^2 = BC \times DC \rightarrow (2)$

(1) + (2)

$AB^2 + AC^2 = BC(BD + DC)$

$\boxed{AB^2 + AC^2 = BC^2}$

Hence proved.

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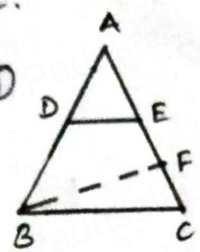
Converse of BPT

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



Given: $\triangle ABC$, $\frac{AD}{DB} = \frac{AE}{EC}$ — ①

To prove: $DE \parallel BC$

Const: Draw $BF \parallel DE$

Proof: Since $BF \parallel DE$ by Thales theorem

$\frac{AD}{DB} = \frac{AF}{EF}$ — ②

From ① & ②

$\frac{AE}{EC} = \frac{AF}{EF}$ ∴ $EC = EF$

$\boxed{C = F}$

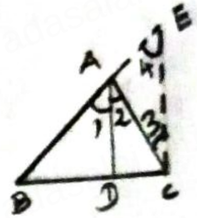
$\boxed{F \text{ lies on } C}$

∴ $DE \parallel BC$

Hence proved.

Converse of ABT

If a straight line through one vertex of a triangle divides the opposite side internally in the ratio of the other two sides then the line bisects the angle internally at the vertex.



Given: $\triangle ABC$, $\frac{AB}{AC} = \frac{BD}{DC}$ → ①

To prove: AD bisects $\angle A$

∴ $\angle 1 = \angle 2$

Const: Draw $CE \parallel DA$

Extend BA to meet at E.

Proof: $AD \parallel CE$ by Thales theorem

$\frac{BD}{DC} = \frac{AB}{AE}$ → ②

from ① & ②

$\frac{AB}{AC} = \frac{AB}{AE}$

$AC = AE$

$\angle 4 = \angle 3$ (opposite angles to equal sides)

$\angle 2 = \angle 3$ (alternate angles)

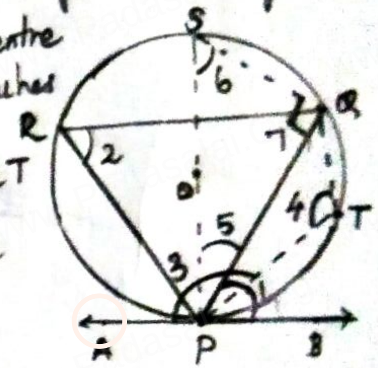
$\angle 1 = \angle 4$ (corresponding angles)

∴ $\boxed{\angle 1 = \angle 2}$ ⇒ AD bisects $\angle A$

Hence proved.

Alternate Segment Theorem

If from the point of contact of a tangent of a circle, a chord is drawn, then the angles between the tangent and the chord are respectively equal to the angles in the corresponding alternate segments.



Given: A circle with centre at O, tangent AB touches the circle at P and PQ is a chord. R and T are two points on the circle in the opposite sides of chord PQ.

To prove: i) $\angle 1 = \angle 2$
ii) $\angle 3 = \angle 4$

Const: Draw the diameter POS. Draw QS, QT, PT and PR.

Proof: ① $\angle 1 + \angle 5 = 90°$ (tangent ⊥ radius)

② $\angle 5 + \angle 6 = 90°$ (Angle in semicircle $\angle 7 = 90°$)

∴ ③ $\angle 1 = \angle 6$

④ $\angle 6 = \angle 2$ (Angles in same segment)

⑤ $\boxed{\angle 1 = \angle 2}$ Hence (i) is proved

⑥ $\angle 2 + \angle 4 = 180°$ (PTQR is a cyclic quadrilateral)

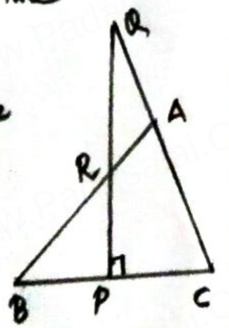
⑦ $\angle 3 + \angle 1 = 180°$ (linear pair)

∴ $\boxed{\angle 3 = \angle 4}$ (∵ $\angle 1 = \angle 2$)

Hence (ii) is proved.

Menelaus Theorem

A necessary and sufficient condition for points P, Q, R on the respective sides BC, CA, AB (or their extension) of a triangle ABC to be collinear is that $\frac{BP}{PC} \times \frac{CQ}{QA} \times \frac{AR}{RB} = -1$ where all segments in the formula are directed segments.



Ceva's Theorem

Let ABC be a triangle and let D, E, F be points on lines BC, CA, AB respectively. Then the cevians AD, BE, CF are concurrent if and only if $\frac{BD}{DC} \times \frac{CE}{EA} \times \frac{AF}{FB} = 1$

Where the lengths are directed.

This also works for the reciprocal of each of the ratios as the reciprocal of 1 is 1.