DAY 9

In last section, we have discussed about similarity and its application Area Theorem. In this section, we shall discuss one very important concept PYTHAGORAS THEOREM.

PYTHAGORAS THEOREM

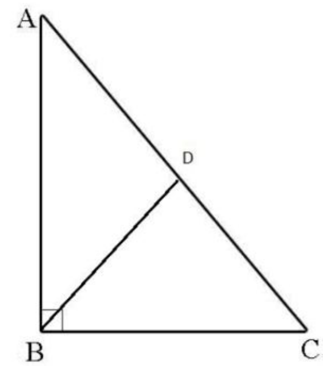
In earlier classes you have already studied about an important theorem known as the Pythagoras theorem (Also known as **Baudhayan** Theorem) named on the famous mathematician Pythagoras we will prove this theorem now:

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

Given ΔABC is right angled at B.

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

Construction Draw $BD \perp AC$



Proof :- In ΔABD and ΔACB, we've

$\angle D = \angle B = 90^0$

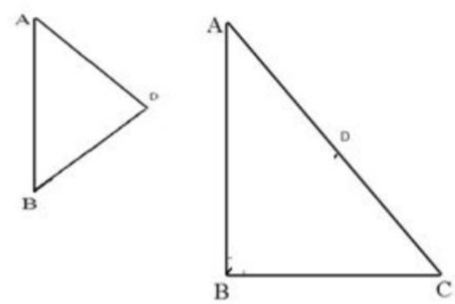
$\angle A = \angle A$ (common)

$\therefore \Delta ABD \sim \Delta ACB$ (AA Similarity)

$$\Rightarrow \quad \frac{\mathbf{AB}}{\mathbf{AC}} = \frac{BD}{BC} = \frac{\mathbf{AD}}{\mathbf{AB}}$$

From first and last, we get

$\mathbf{AB^2 = AD \times AC}$.....................i)



In ΔBDC and ΔABC, we've

$\angle D = \angle B = 90^0$

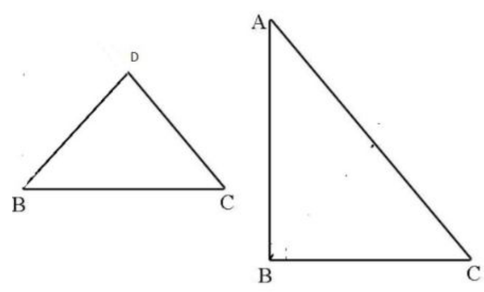
$\angle C = \angle C$ (common)

$\therefore \Delta BDC \sim \Delta ABC$ (AA Similarity)

$$\Rightarrow \quad \frac{\mathbf{BC}}{\mathbf{AC}} = \frac{BD}{AB} = \frac{\mathbf{CD}}{\mathbf{BC}}$$

From first and last, we get

$\mathbf{BC^2 = AC \times AD}$.....................ii)



Adding i) & ii), we get

$AB^2 + BC^2 = AD \times DC + CD \times AC$

$= AC(AD + DC) = AC \times AC$

$\therefore \quad AB^2 + BC^2 = AC^2$

Now we shall discuss some examples based on Pythagoras Theorem.

1. A ladder 10m long reaches a window 8m above the ground. Find the distance of the foot of the ladder from base of the wall. [Ex 6.5, Q9]

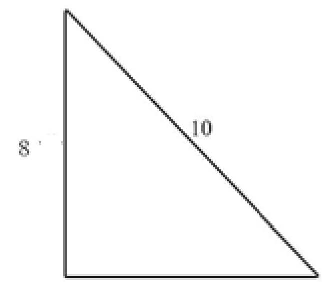
Sol:- By Pythagoras Theorem, we get

$$H^2 = P^2 + B^2$$

$\Rightarrow \quad 10^2 = 8^2 + B^2 \qquad \Rightarrow \quad 100 = 64 + B^2$

$\Rightarrow \quad B^2 = 100 - 64 = 36 = 6^2 \qquad \Rightarrow \quad B = 6m$

Hence the distance of the foot of the ladder from base of the wall is $6m$



2. ABC is an equilateral triangle of side $2a$. Find each of its altitude. [Ex 6.5, Q6]

Sol:- Draw $AD \perp BC$

We know in equilateral triangle altitude divides opposite sides in two equal parts.

$i.e. \quad BD = DC = a$

Now in right angled triangle ΔABD

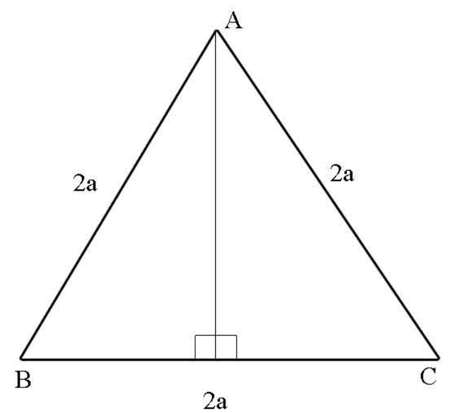
$$AB^2 = AD^2 + BD^2$$

$\Rightarrow \quad (2a)^2 = AD^2 + a^2$

$\Rightarrow \quad 4a^2 = AD^2 + a^2$

$\Rightarrow \quad AD^2 = 4a^2 - a^2 = 3a^2$

$\Rightarrow \quad AD = \sqrt{3a^2} = \sqrt{3}a$



3. Two poles of heights 6m and 11m stand on a plane ground. If the distance between their feet is 12m, find distance between their tops. [Ex 6.5, Q12]

Sol:- According to figure, $AB = 6m$ and $CD = 11m$ are two poles and $BC = 12m$ is the distance between them.

To find AD, for that $AE \perp CD$

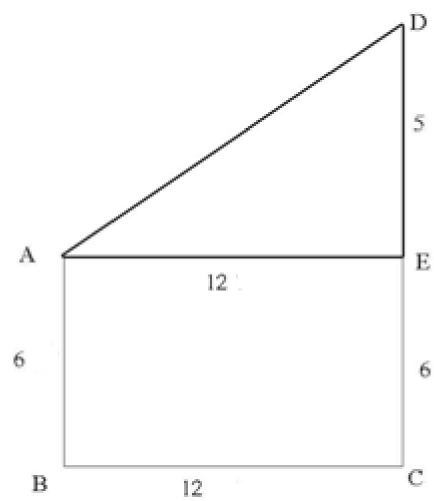
$\therefore \quad AB = CE = 6m$ and $DE = 5m, AE = BC = 12m$

Now in right angled triangle ΔAED

$$AD^2 = AE^2 + ED^2$$

$\Rightarrow \quad AD^2 = 12^2 + 5^2 = 144 + 25 = 169 = 13^2$

$\Rightarrow \quad AD = 13m$



EXERCISE

1. Ex 6.5, Q10,11,16