

# CLASS – 10 MATHEMATICS

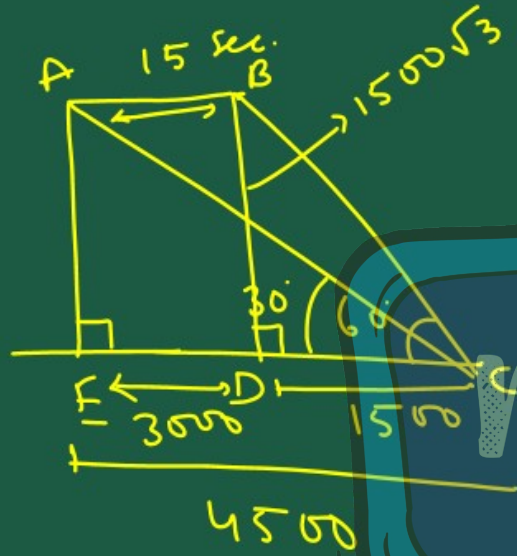
## CH-9 : Some Applications of Trigonometry

CBSE Board

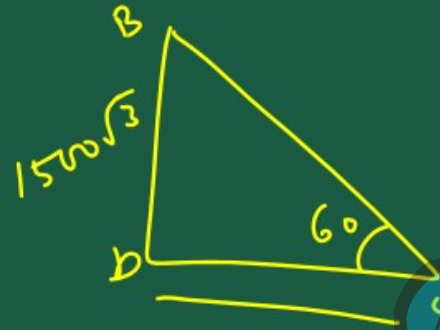
Most Important Questions

Shubham Tiwari





1. The angle of elevation of an aeroplane from a point A on the ground is  $60^\circ$ . After a flight of 15 seconds, the angle of elevation changes to  $30^\circ$ . If the aeroplane is flying at a constant height of  $1500\sqrt{3}\text{m}$ , find the speed of the plane in km/hr.



$$BD = 1500\sqrt{3} \text{ m.}$$

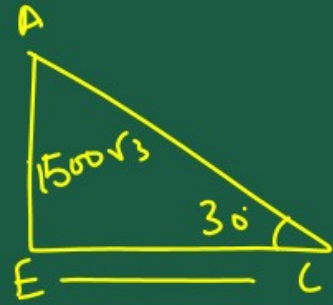
$$\angle BCD = 60^\circ$$

$$\tan \theta = \frac{P}{B}$$

$$\tan 60 = \frac{BD}{DC}$$

$$\sqrt{3} = \frac{1500\sqrt{3}}{DC}$$

$$DC = 1500 \text{ m}$$



$$\tan 30 = \frac{P}{B}$$

$$\frac{1}{\sqrt{3}} = \frac{AE}{EC} = \frac{1500\sqrt{3}}{EC}$$

$$EC = 1500\sqrt{3} \times \sqrt{3}$$

$$EC = 4500 \text{ m.}$$

The distance covered by the plane

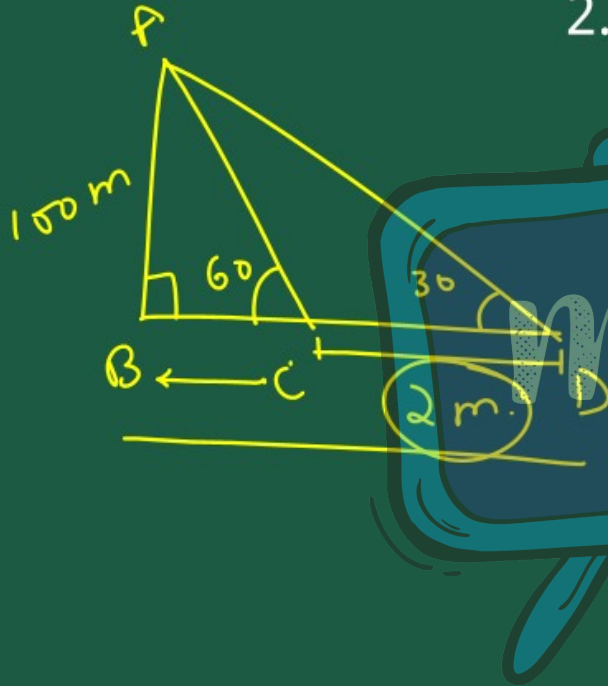
$$AB = DE$$

$$DE = EC - CD$$
$$= 4500 - 1500$$

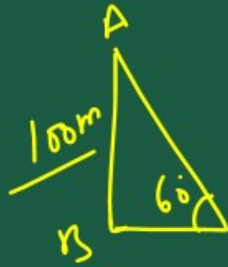
$$DE = 3000 \text{ m.}$$

$$\text{Speed} = \frac{\text{dist}}{\text{Time}} = \frac{3000}{15} = 200 \text{ m/s}$$

$$\text{Speed in km/hr} = 200 \times \frac{18}{5} = 720 \text{ km/hr}$$



2. A man in a boat rowing away from a light house 100 m high takes 2 minutes to change the angle of elevation of the top of the light house from  $60^\circ$  to  $30^\circ$ . Find the speed of the boat in metres per minute.



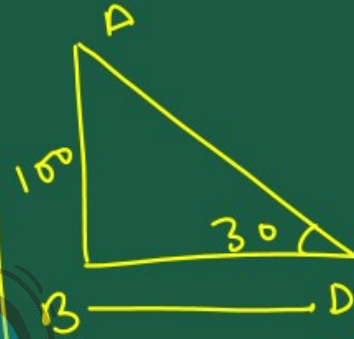
in  $\triangle ABC$

$$\tan \theta = \frac{P}{B}$$

$$\tan 60 = \frac{AB}{BC}$$

$$\sqrt{3} = \frac{100}{BC}$$

$$BC = \frac{100}{\sqrt{3}} \text{ m.}$$



$$\tan \theta = \frac{P}{B} = \frac{AB}{BD}$$

$$\tan 30 = \frac{100}{BD}$$

$$\frac{1}{\sqrt{3}} = \frac{100}{BD}$$

$$BD = 100\sqrt{3} \text{ m.}$$

distance covered by the boat.

$$CD = BD - BC$$

$$= 100\sqrt{3} - \frac{100}{\sqrt{3}}$$

$$= 100 \left[ \frac{\sqrt{3}}{\sqrt{3}} - \frac{1}{\sqrt{3}} \right]$$

$$= 100 \left[ \frac{3-1}{\sqrt{3}} \right]$$

$$\frac{CD}{\sqrt{3}} = \frac{200}{\sqrt{3}} \text{ m.}$$

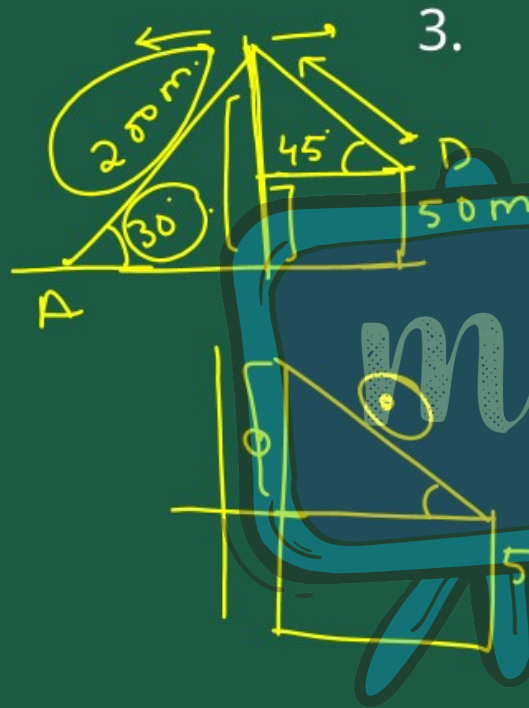
$$\text{Speed} = \frac{\text{dis.}}{\text{Time}}$$

$$\text{Speed} = \frac{CD}{\frac{1}{\sqrt{3}}}$$

$$= \frac{100 \times 2}{\sqrt{3}} \times \frac{1}{\cancel{2}}$$

$$\text{Speed} = \frac{100}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

$$\text{Speed} = \frac{100\sqrt{3}}{3} \text{ m/m}$$



3. Amit, standing on a horizontal plane, finds a bird flying at a distance of 200 m from him at an elevation of  $30^\circ$ . Deepak standing on the roof of a 50 m high building, finds the angle of elevation of the same bird to be  $45^\circ$ . Amit and Deepak are on opposite sides of the bird. Find the distance of the bird from Deepak.

in  $\triangle ABE$ ,  $AE = 200\text{m}$ .  
 $\angle A = 30^\circ$

$$\sin \theta = \frac{P}{H} = \frac{BE}{AE}$$

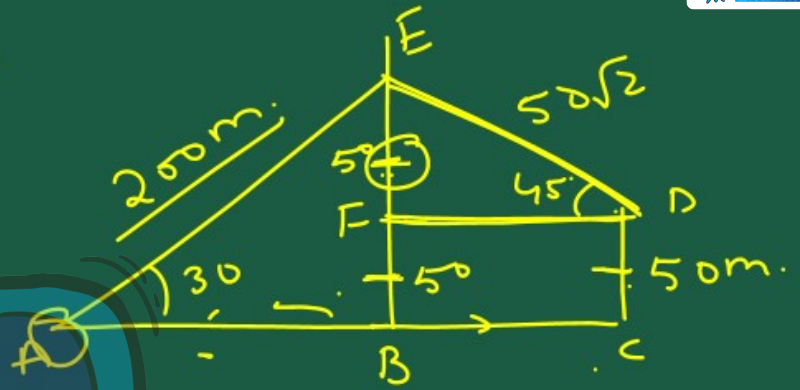
$$\sin 30^\circ = \frac{BE}{200}$$

$$\frac{1}{2} = \frac{BE}{200}$$

$$BE = 100\text{m}$$

Hence  $EF = BE - BF$   
 $= 100 - 50$

$$EF = 50\text{m}$$



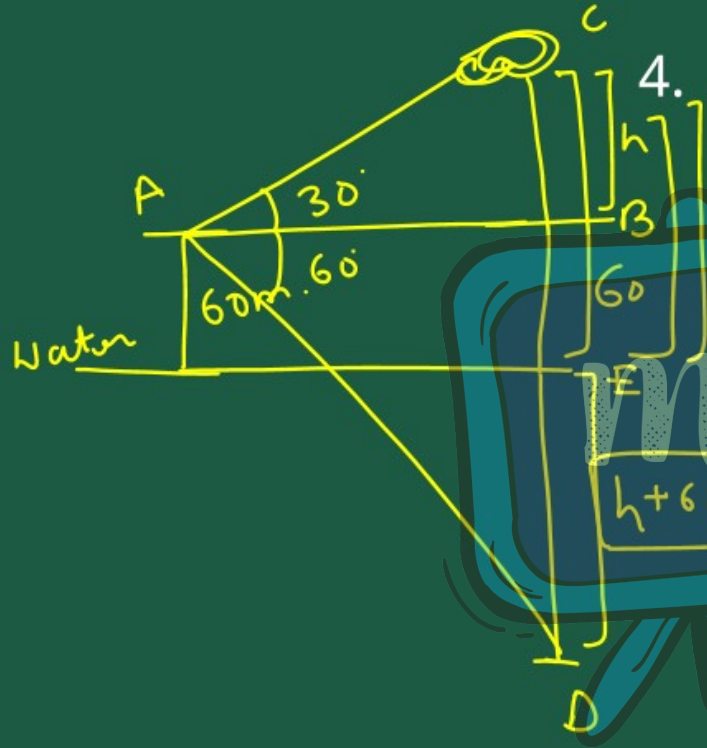
$\triangle EFD$ ,  $EF = 50\text{m}$ .  
 $\angle D = 45^\circ$

$$\sin \theta = \frac{P}{H} = \frac{EF}{DE}$$

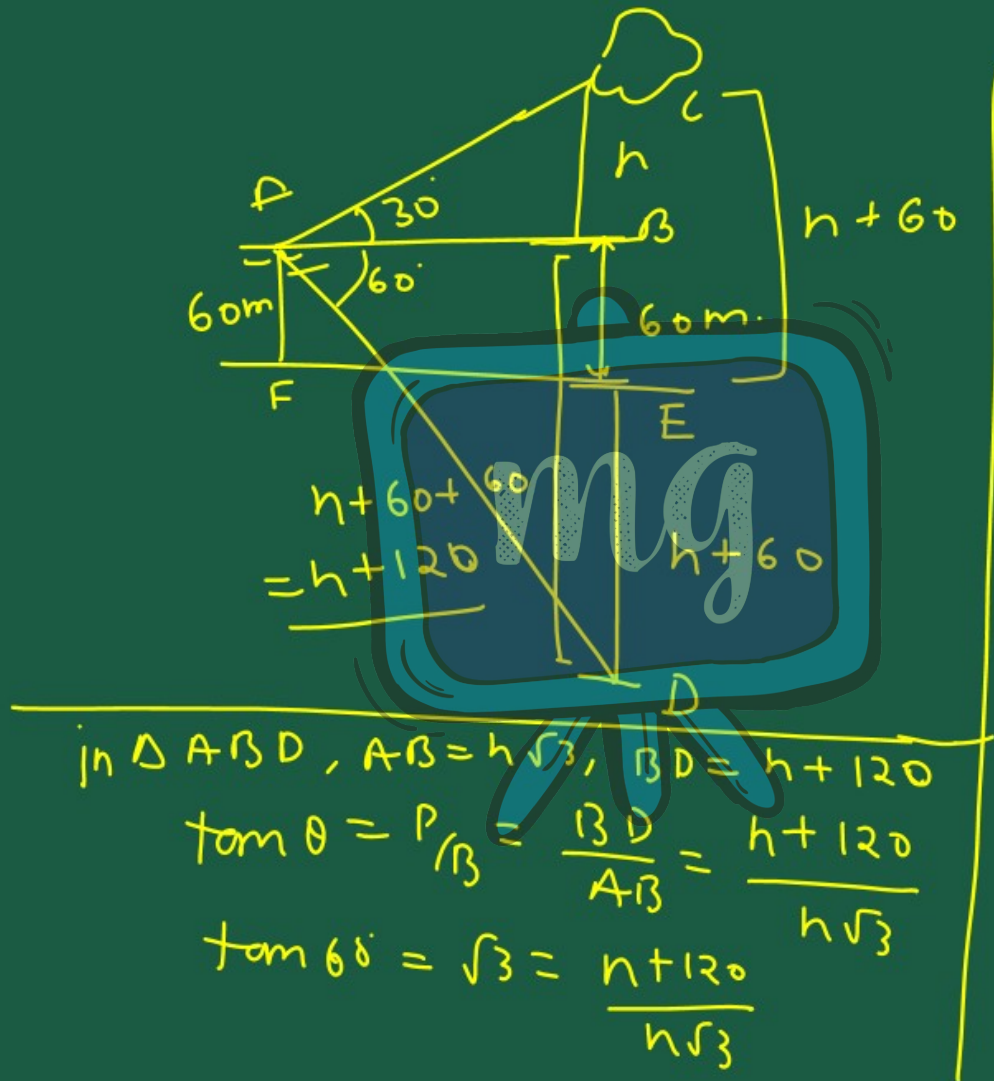
$$\sin 45^\circ = \frac{50}{DE}$$

$$\frac{1}{\sqrt{2}} = \frac{50}{DE}$$

$$DE = 50\sqrt{2}\text{m}$$



4. The angle of elevation of a cloud from a point 60 m above the surface of the water of a lake is  $30^\circ$  and the angle of depression of its shadow in water of lake is  $60^\circ$ . Find the height of the cloud from the surface of water.



in  $\triangle ABC$

$$BC = h, \angle A = 30^\circ$$

$$\tan \theta = \frac{h}{AB}$$

$$\tan 30^\circ = \frac{h}{AB}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{AB}$$

$$AB = h\sqrt{3} \text{ m.}$$

in  $\triangle ABD$ ,  $AB = h\sqrt{3}$ ,  $BD = h+120$

$$\tan \theta = \frac{BD}{AB} = \frac{h+120}{h\sqrt{3}}$$

$$\tan 60^\circ = \sqrt{3} = \frac{h+120}{h\sqrt{3}}$$

$$\sqrt{3} = \frac{h + 120}{\sqrt{3} h}$$

$$3h = h + 120$$

$$2h = 120$$

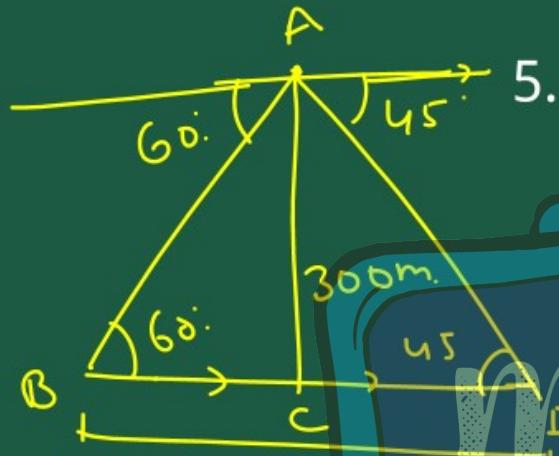
$$h = 60 \text{ m.}$$

height of the cloud.

$$CE = h + 60$$

$$= 60 + 60$$

$$CE = 120 \text{ m.}$$



In  $\Delta ABC$ ,  $AC = 300\text{m}$ .

$$\angle B = 60^\circ$$

$$\tan 60^\circ = \frac{P}{R} = \frac{300}{BC}$$

$$\sqrt{3} = \frac{300}{BC}$$

5. An aeroplane is flying at a height of 300 m above the ground. Flying at this height, the angles of depression from the aeroplane of two points on both banks of a river in opposite directions are  $45^\circ$  and  $60^\circ$  respectively. Find the width of the river.

$$BC = \frac{300}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$
$$= \frac{300\sqrt{3}}{3}$$

$$BC = 100\sqrt{3} \text{ m}$$

The width of the river

$$BC + CD = BD$$
$$100\sqrt{3} + 300$$

$$100(\sqrt{3} + 3) \text{ m} = BD$$

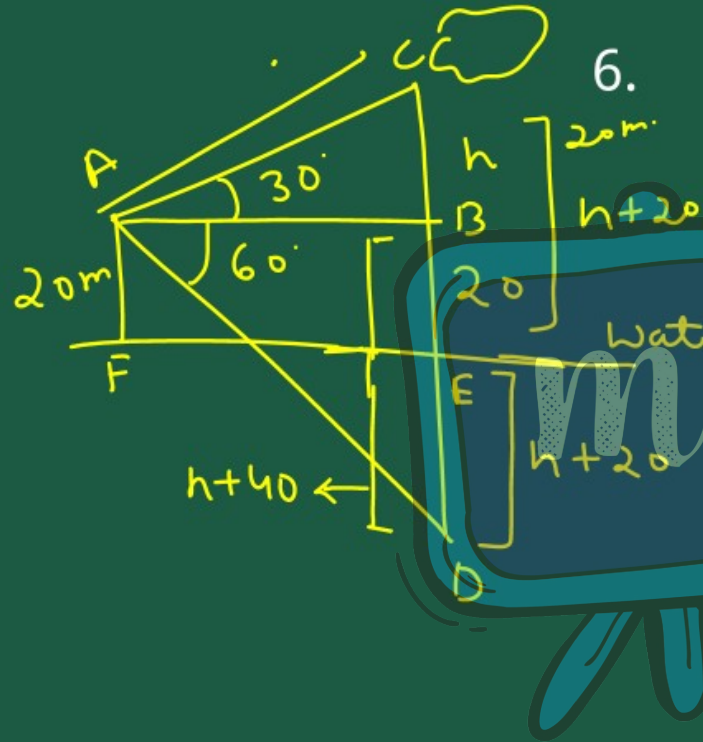
In  $\triangle ADC$ ,  $AC = 300 \text{ m}$ .

$$\angle D = 45^\circ$$

$$\tan 45^\circ = \frac{P}{B} = \frac{AC}{DC}$$

$$1 = \frac{300}{DC}$$

$$DC = 300 \text{ m}$$



6. At a point A, 20 metres above the level of water in a lake, the angle of elevation of a cloud is  $30^\circ$ . The angle of depression of the reflection of the cloud in the lake, at A is  $60^\circ$ . Find the distance of the cloud from A.

in  $\triangle ABC$ ,  $BC = h$

$\angle A = 30^\circ$

$$\tan \theta = \frac{P}{B}$$

$$\tan 30^\circ = \frac{h}{AB}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{AB}$$

$$AB = \sqrt{3}h$$

in  $\triangle ABD$ ,  $BD = h + 40\text{m}$ .

$\angle A = 60^\circ$

$$\tan 60^\circ = \frac{P}{B} = \frac{h+40}{AB}$$

$$\sqrt{3} = \frac{h+40}{\sqrt{3}h}$$

$$3h = h + 40$$

$$2h = 40$$

$$h = 20\text{m}$$

in  $\triangle ABC$ ,

$$\sin 30^\circ = \frac{p}{H}$$

$$\frac{1}{2} = \frac{20}{H}$$

$$H = 40 \text{ m}$$

$$h = 20 \text{ m}, \quad AB = 20\sqrt{3}$$

$$H^2 = p^2 + B^2$$

$$AC^2 = AB^2 + BC^2$$

$$= (20)^2 + (20\sqrt{3})^2$$

$$= 20^2 + 20^2 \times 3$$

$$= 20^2 [1+3]$$

$$AC^2 = 20^2 \times 4$$

$$AC^2 = 20^2 \times 2^2$$

$$AC = 20 \times 2$$

$$AC = 40 \text{ m.}$$