If the angle of depression of an object from a 75 m high tower is 30°, then the distance of the object from the tower is

(a) $25\sqrt{3}$ m (b) $50\sqrt{3}$ m

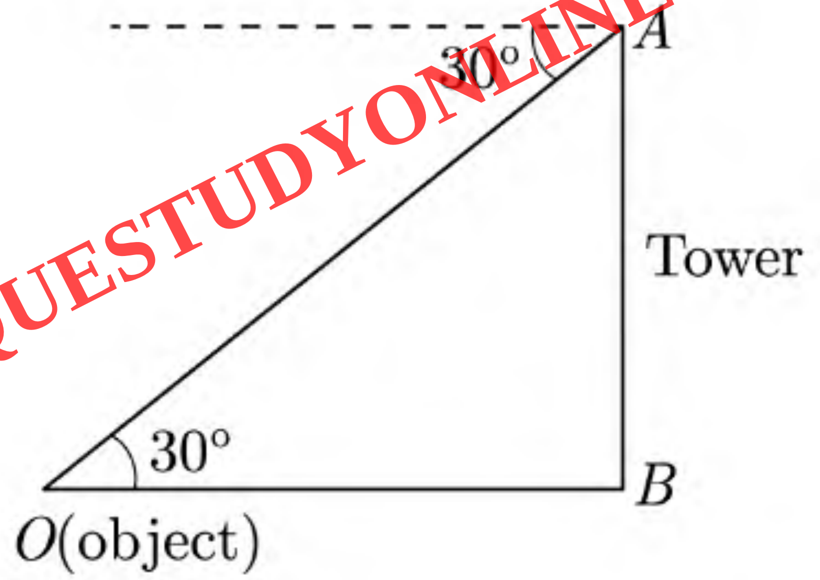
(c) $75\sqrt{3}$ m (d) 150 m

We have

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

$$\frac{1}{\sqrt{3}} = \frac{75}{OB}$$

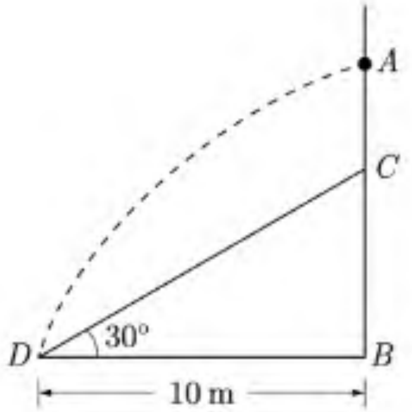
$$OB = 75\sqrt{3} \text{ m}$$



Thus (c) is correct option.

A tree is broken by the wind. The top struck the ground at an angle of 30° and at distance of 10 m from its root. The whole height of the tree is ($\sqrt{3} = 1.732$)

(a) $10\sqrt{3}$ m
(b) $3\sqrt{10}$ m
(c) $20\sqrt{3}$ m
(d) $3\sqrt{20}$ m



Now $\quad AC = CD$

$$\angle CDB = 30^\circ$$

$$BD = 10 \text{ m}$$

In $\Delta\, CDB$, $\quad \tan 30^\circ = \frac{CB}{DB} = \frac{CB}{10}$

$$\frac{1}{\sqrt{3}} = \frac{CB}{10}$$

$$CB = \frac{10}{\sqrt{3}}$$

Also, $\quad \cos 30^\circ = \frac{DB}{DC} = \frac{10}{DC}$

$$DC = \frac{20}{\sqrt{3}} = AC$$

Height of tree,

$$AC + CB = \frac{20}{\sqrt{3}} + \frac{10}{\sqrt{3}} = \frac{30}{\sqrt{3}}$$

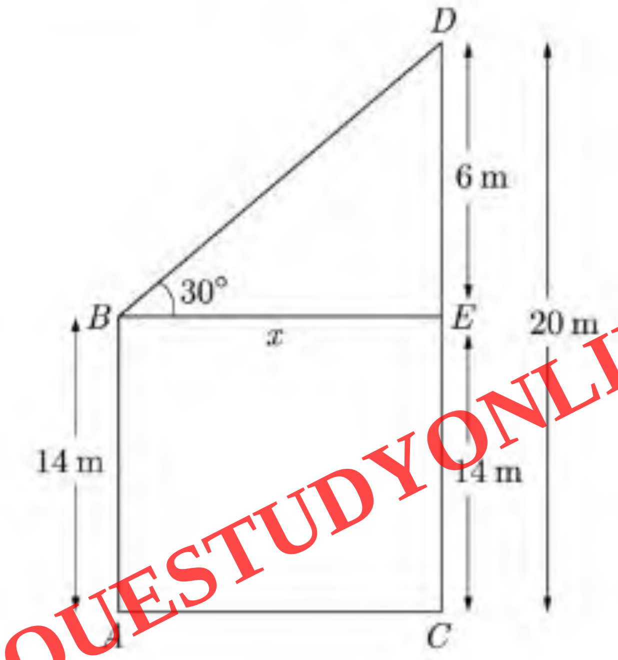
$$= 10\sqrt{3} \text{ m}$$

Thus (a) is correct option.

The top of two poles of height 20 m and 14 m are connected by a wire. If the wire makes an angle of 30° with the horizontal, then the length of the wire is

(a) 12 m
(b) 10 m
(c) 8 m
(d) 6 m

Height of big pole	CD	$= 20\text{ m}$
Height of small pole	AB	$= 14\text{ m}$



$$DE = CD - CE$$

$$= CD - AB \qquad [AB = CE]$$

$$= 20 - 14 = 6\text{ m}$$

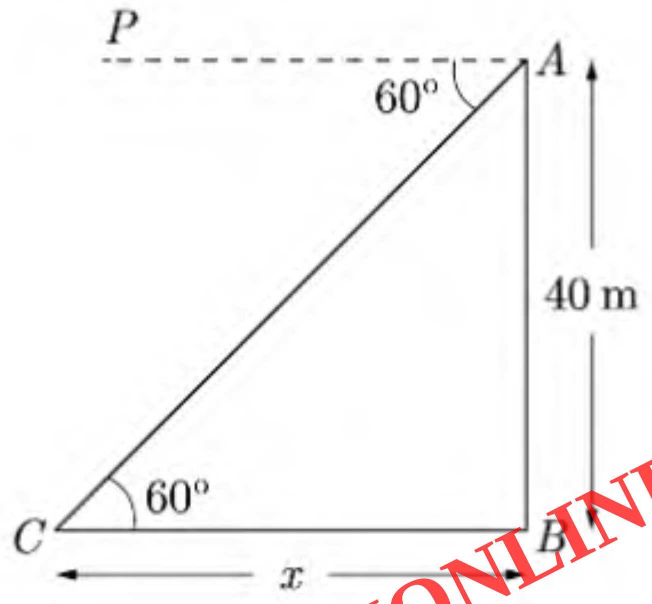
In ΔBDE, $\sin 30^\circ = \frac{DE}{BD}$

$$\frac{1}{2} = \frac{6}{BD} \Rightarrow BD = 12\text{ m}$$

Thus length of wire is 12 m.

Thus (a) is correct option.

From the top of light house, 40 m above the water, the angle of depression of a small boat is 60°. Find how far the boat is from the base of the light house.



Since $\angle PAC = 60^\circ \Rightarrow \angle ACB = 60^\circ$

Let $CB = x$. Now in ΔABC,

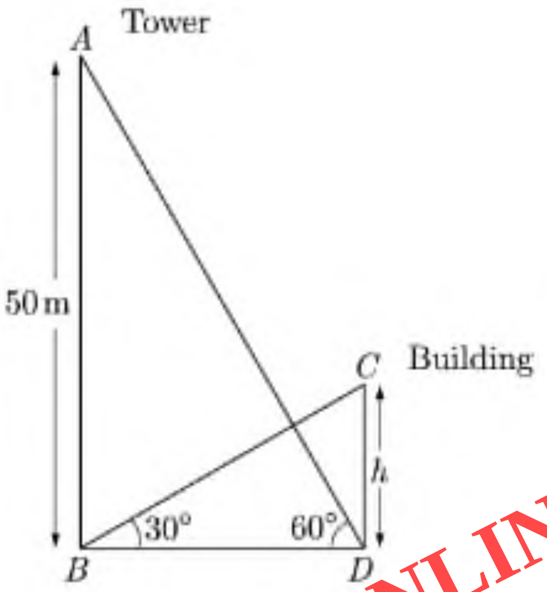
$$\tan 60^\circ = \frac{AB}{BC}$$

$$\sqrt{3} = \frac{40}{x}$$

$$x = \frac{40}{\sqrt{3}} = \frac{40 \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}} = \frac{40\sqrt{3}}{3} \text{ m}$$

Hence, the boat is $\frac{40\sqrt{3}}{3}$ m away from the foot of light house.

The angle of elevation of the top of a building from the foot of a tower is 30° and the angle of elevation of the top of a tower from the foot of the building is 60°. If the tower is 50 m high, then find the height of the building.



In ΔABD, $\quad \tan 60^\circ = \frac{AB}{BD}$

$$\sqrt{3} = \frac{50}{BD}$$

$$BD = \frac{50}{\sqrt{3}}$$

Now in ΔBDC,

$$\tan 30^\circ = \frac{CD}{BD}$$

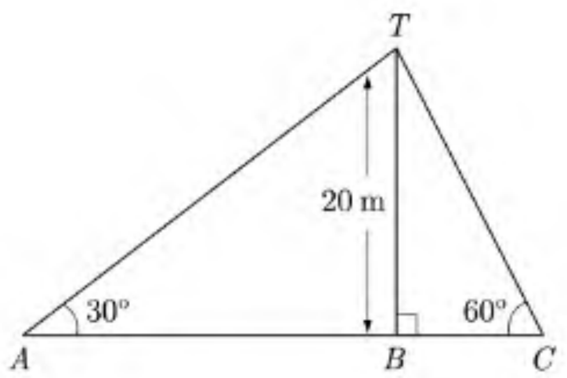
$$\frac{1}{\sqrt{3}} = \frac{h}{\frac{50}{\sqrt{3}}} = \frac{h\sqrt{3}}{50}$$

$$3h = 50$$

$$h = \frac{50}{3} = 16.67$$

Hence, the height of the building is 16.67 m.

Two men standing on opposite sides of a tower measure the angles of elevation of he top of the tower as 30° and 60° respectively. If the height of the tower in 20 m, then find the distance between the two men.



In right angle triangle $\Delta\, ABT$,

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

$$\frac{1}{\sqrt{3}} = \frac{20}{AB}$$

$$AB = \sqrt{3}\,20$$

In right angle triangle $\Delta\, TBC$,

$$\tan 60^\circ = \frac{BT}{BC}$$

$$\sqrt{3} = \frac{20}{BC}$$

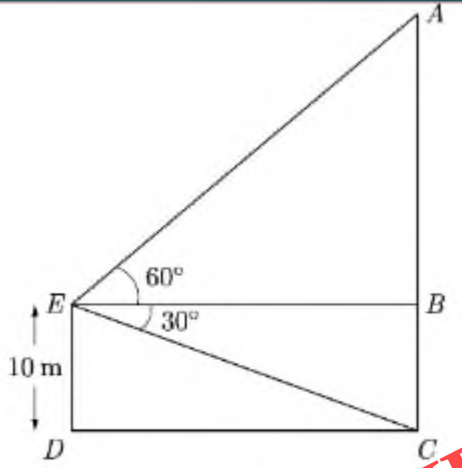
$$BC = \frac{20}{\sqrt{3}}$$

Thus distance between two men,

$$AB + BC = 20\sqrt{3} + \frac{20}{\sqrt{3}} = \frac{60+20}{\sqrt{3}} = \frac{80\sqrt{3}}{3} \text{ m.}$$

Hence, distance between the men is $\frac{80\sqrt{3}}{3}$ m.

A man standing on the deck of a ship, which is 10 m above water level, observes the angle of elevation of the top of a hill as 60° and the angle of depression of the base of hill as 30°. Find the distance of the hill from the ship and the height of the hill.



In ΔBCE, $BC = EC = 10$ m and

$$\angle BEC = 30^\circ$$

Now $$\tan 30^\circ = \frac{BC}{BE}$$

$$\frac{1}{\sqrt{3}} = \frac{10}{BE}$$

$$BE = 10\sqrt{3}$$

Since $BE = CD$, distance of hill from ship

$$CD = 10\sqrt{3}\,\text{m} = 10 \times 1.732 \text{ m}$$
$$= 17.32 \text{ m}$$

Now in ΔABE, $\angle AEB = 60^\circ$

where $AB = h$, $BE = 10\sqrt{3}$ m

and $$\angle AEB = 60^\circ$$

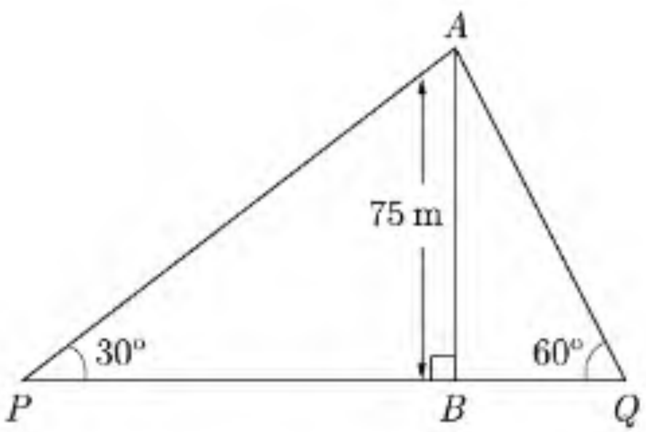
Thus $$\tan 60^\circ = \frac{AB}{BE}$$

$$\sqrt{3} = \frac{AB}{10\sqrt{3}}$$

$$AB = 10\sqrt{3} \times \sqrt{3} = 30 \text{ m}$$

Thus height of hill $AB + 10 = 40$ m

Two men on either side of a 75 m high building and in line with base of building observe the angles of elevation of the top of the building as 30° and 60°. Find the distance between the two men. (Use $\sqrt{3} = 1.73$)



In $\Delta\, ABP$, $\quad \tan 30^\circ = \dfrac{AB}{BP}$

$$\frac{1}{\sqrt{3}} = \frac{75}{BP}$$

$$BP = 75\sqrt{3} \text{ m}$$

In $\Delta\, ABQ$, $\quad \tan 60^\circ = \dfrac{AB}{BQ}$

$$\sqrt{3} = \frac{75}{BQ}$$

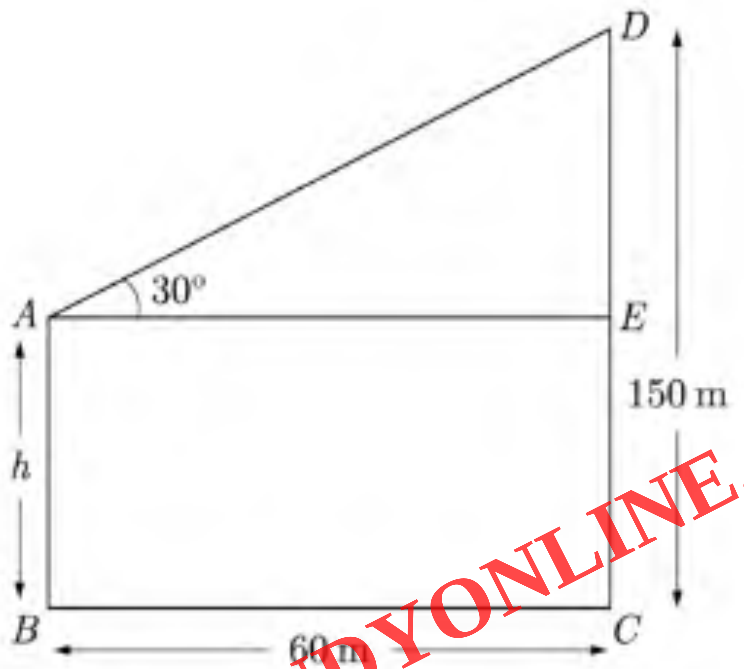
$$BQ = \frac{75}{\sqrt{3}} = 25\sqrt{3}$$

Distance between the two men,

$$PQ = BP + BQ = 75\sqrt{3} + 25\sqrt{3}$$

$$= 100\sqrt{3} = 100 \times 1.73 = 173$$

The horizontal distance between two towers is 60 m. The angle of elevation of the top of the taller tower as seen from the top of the shorter one is 30°. If the height of the taller tower is 150 m, then find the height of the shorter tower.



Here $BC = AE = 60$ m, $DE = DC - EC = (150 - h)$

In ΔAED,

$$\frac{DE}{AE} = \tan 30^\circ$$

$$\frac{150 - h}{60} = \tan 30^\circ = \frac{1}{\sqrt{3}}$$

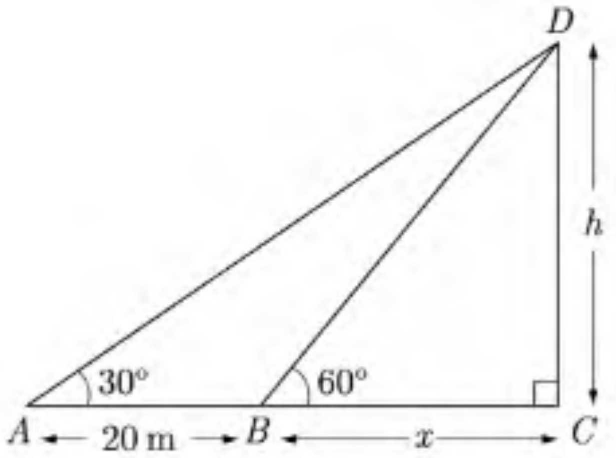
$$150\sqrt{3} - h\sqrt{3} = 60$$

$$\sqrt{3}\,h = 150\sqrt{3} - 60$$

$$\sqrt{3}\,h = 150\sqrt{3} - 20\sqrt{3} \times \sqrt{3}$$

or $$h = (150 - 20\sqrt{3})\text{ m}$$

The angle of elevation of the top of a tower from a point A on the ground is 30°. On moving a distance of 20 metre towards the foot of the tower to a point B the angle of elevation increase to 60°. Find the height of the tower and the distance of the tower from the point A.



In right $\Delta\, DBC$, $\quad \dfrac{h}{x} = \tan 60^\circ$

$$h = \sqrt{3}\, x \qquad \text{...(1)}$$

In right $\Delta\, ADC$,

$$\frac{h}{x+20} = \tan 30^\circ = \frac{1}{\sqrt{3}}$$

$$\sqrt{3}\, h = x + 20 \qquad \text{...(2)}$$

Substituting the value of h from eq. (1) in eq. (2), we get

$$3x = x + 20$$

$$x = 10 \text{ m} \qquad \text{...(3)}$$

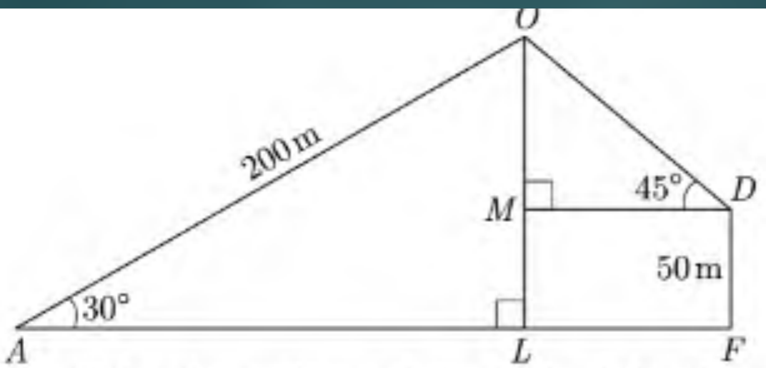
Thus $\quad AC = 20 + x = = 30$ m.

and $\quad h = \sqrt{3} \times 10 = 10\sqrt{3}$

$$= 10 \times 1.732 = 17.32 \text{ m}$$

Hence, height of tower is 17.32 m and distance of tower from point A is 30 m.

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



Let O be the position of the bird, A be the position for Amit, D be the position for Deepak and FD be the building at which Deepak is standing at height 50 m.

In $\Delta\, OLA$, $\angle L = 90^\circ$

$$\sin 30^\circ = \frac{OL}{OA}$$

$$\frac{1}{2} = \frac{OL}{200} \Rightarrow OL = \frac{200}{2} = 100 \text{ m}$$

$$OM = OL - LM$$

$$= OL - FD$$

$$= (100 - 50) \text{ m} = 50 \text{ m}$$

In $\Delta\, OMD$, $\angle M = 90^\circ$

$$\sin 45^\circ = \frac{OM}{OD}$$

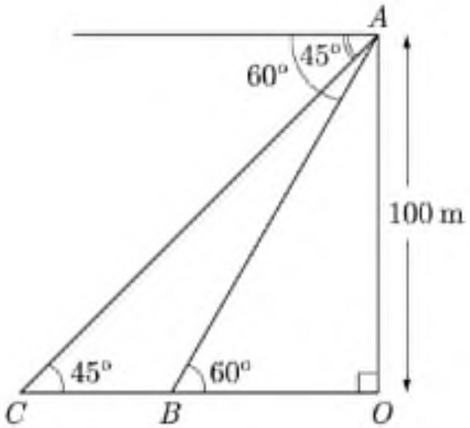
$$\frac{1}{\sqrt{2}} = \frac{50}{OD}$$

$$OD = 50\sqrt{2}$$

$$= 50 \times 1.414 = 70.7 \text{ m}$$

Thus, the distance of the bird from the Deepak is 70.7 m.

From a top of a building 100 m high the angle of depression of two objects are on the same side observed to be 45° and 60°. Find the distance between the objects.



Here $\angle ACO = \angle CAX = 45^\circ$

and $\angle ABO = \angle XAB = 60^\circ$

In right ΔAOC, $\dfrac{AO}{CO} = \tan 45^\circ$

$$\frac{100}{CO} = 1$$

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

Also in right ΔAOB, we have

$$\frac{AO}{OB} = \tan 60^\circ$$

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

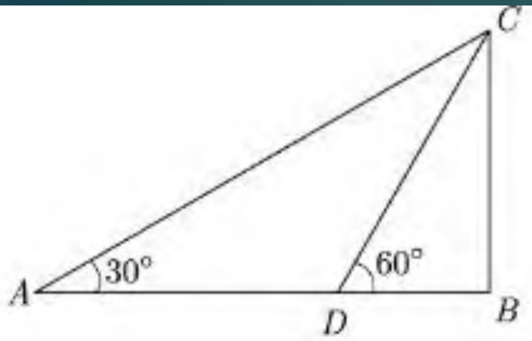
$$OB = \frac{100}{\sqrt{3}}$$

Thus $BC = CO - OB = 100 - \dfrac{100}{\sqrt{3}}$

$$= 100\left(1 - \frac{1}{\sqrt{3}}\right) = 100\frac{(\sqrt{3}-1)}{\sqrt{3}}$$

$$= 100\frac{(\sqrt{3}-1)}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

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° to 30°. Find the speed of the boat in metres per minute. [Use $\sqrt{3} = 1.732$]



Here D is first position and A is position after 2 minutes.

Height of the light house,

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

From ΔDBC, $\angle B = 90^\circ$

So, $\tan 60^\circ = \frac{BC}{BD}$

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

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

Now, after time 2 minute boat is at A. New distance from light house is AB and angle is 30°.

From ΔABC, $\angle B = 90^\circ$

So, $\tan 30^\circ = \frac{BC}{AB}$

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

$$AB = 100\sqrt{3}$$

Therefore, distance d travelled in 2 min,

$$AD = AB - DB = 100\sqrt{3} - \frac{100}{3}$$

$$= 173.2 - \frac{100}{3}\sqrt{3}$$

$$= 173.2 - 57.73$$

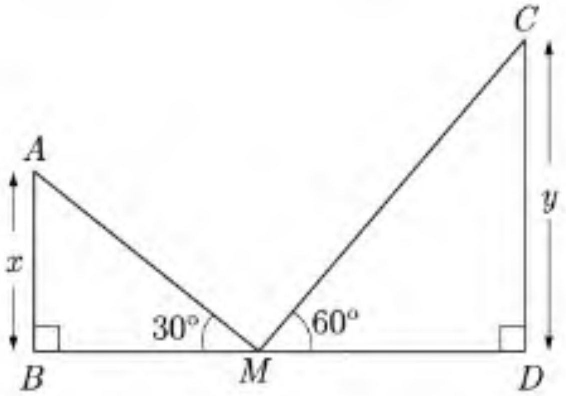
$$= 115.47 \text{ m}$$

Speed $s = \frac{d}{t} = \frac{115.47 \text{ m}}{2 \text{ min}}$

$$= 57.74 \text{ m/ min}$$

Hence, going away from the light house with a speed 57.74 m/ min.

The tops of two towers of height x and y, standing on level ground, subtend angles of 30° and 60° respectively at the centre of the line joining their feet, then find $x : y$.



Here M is the centre of the line joining their feet.
Let $BM = MD = z$

In right $\Delta\, ABM$ we have,

$$\frac{x}{z} = \tan 30^\circ$$

$$x = z \times \frac{1}{\sqrt{3}}$$

In right $\Delta\, CDM$ we have,

$$\frac{y}{z} = \tan 60^\circ$$

$$y = z \times \sqrt{3}$$

From (1) and (2), we get

$$\frac{x}{y} = \frac{z \times \frac{1}{\sqrt{3}}}{z \times \sqrt{3}}$$

$$\frac{x}{y} = \frac{1}{3}$$

Thus $\quad x : y = 1 : 3$