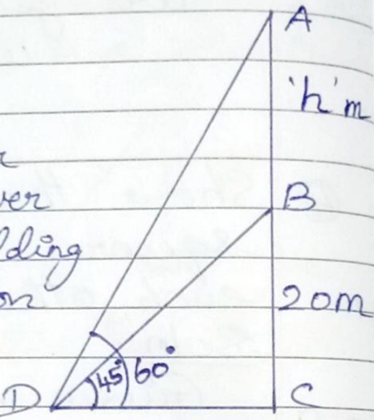
classmate
Date
Page

CBSE - Class - 10
Exercise 9.1 (Continued)

(7) From a point on the ground, the angles of elevation of the bottom and top of a transmisson tower fixed at the top of a 20m high building are 45° and 60° respectively. Find the height of the tower.

Soln:-



A → Top of the tower
B → Bottom of the tower
C → Bottom of the building
D – Point of observation

In ΔACD,

$$\tan 60° = \frac{AC}{DC}$$

$$\sqrt{3} = \frac{20+h}{DC} \rightarrow (1)$$

In ΔBCD,

$$\tan 45° = \frac{BC}{DC} \rightarrow (2)$$

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

$$\Rightarrow BC = DC = 20 \text{ m.}$$

Sub $DC = 20$ in (1)

$$\sqrt{3} = \frac{20+h}{20}$$

$$20\sqrt{3} = 20+h \Rightarrow h = 20\sqrt{3} - 20$$

$$= 20(\sqrt{3}-1) \text{ metre}$$

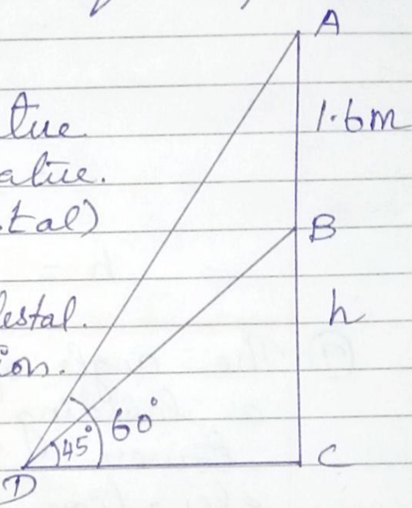
classmate

Date

Page

(8) A statue 1.6m tall stands on the top of a pedestal. From a point on the ground, the angle of elevation on the top of a the statue is $60°$ and from the same point the angle of elevation of the top of the pedestal is $45°$. Find the height of the pedestal.

Soln:



A → Top of the statue

B → Bottom of the statue. (Top of the pedestal)

C → Bottom of the Pedestal.

D → Point of observation.

In $\triangle ACD$,

$$\tan 60° = \frac{AC}{DC}$$

$$\sqrt{3} = \frac{1.6+h}{DC} \rightarrow (1)$$

In $\triangle BCD$,

$$\tan 45° = \frac{BC}{DC}$$

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

$$\Rightarrow BC = DC = h \rightarrow (2)$$

(1) becomes, $\sqrt{3} = \frac{1.6+h}{h}$

$$\sqrt{3}h = 1.6 + h$$

$$\sqrt{3}h - h = 1.6$$

$$h(\sqrt{3}-1) = 1.6$$

$$h = \frac{1.6}{\sqrt{3}-1}$$

$$= \frac{1.6}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1}$$

$$= \frac{1.6(\sqrt{3}+1)}{(\sqrt{3})^2-1}$$

$$= \frac{1.6(\sqrt{3}+1)}{2}$$

$h = 0.8(\sqrt{3}+1)$ metre.

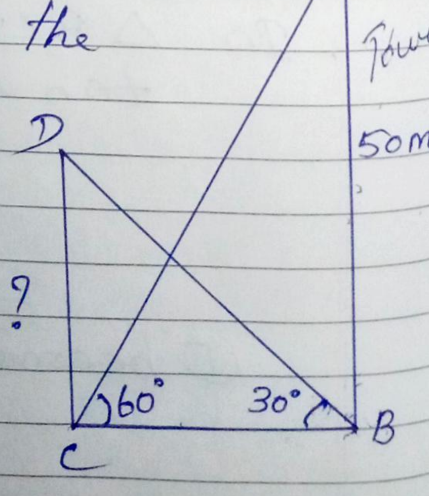
---

(9) The angle of elevation of the top of a building from the foot of a tower is $30°$ and the angle of elevation of top of the tower from the foot of the building is $60°$. If the tower is 50m, find the height of the building.

Soln:

Let the height of the building be 'h' m.

i.e., $CD = h$.



In ΔABC

$$\tan 60° = \frac{AB}{BC}$$

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

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

$$BC = \frac{50}{\sqrt{3}} \rightarrow (1)$$

In ΔBCD,

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

$$\frac{1}{\sqrt{3}} = \frac{CD}{BC}$$

$$BC = \sqrt{3}\, CD$$
$$= \sqrt{3}\, h \quad (\because CD = h)$$

$$BC = \sqrt{3}\, h \rightarrow (2)$$

from (1) and (2).

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

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

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

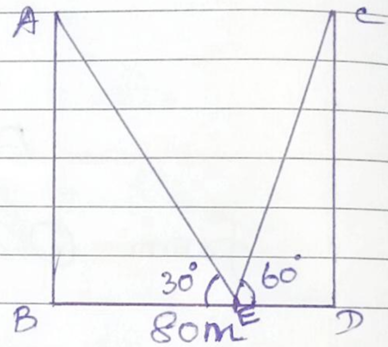
$$16\frac{2}{3} = h$$

$\therefore$ height of the building $= 16\frac{2}{3}$ m

classmate
Date
Page

10 Two poles of equal heights are standing opposite to each other on either side of the road which is 80m wide. From a point between them on the road, the angles of elevation of the top of the poles are 60° and 30° respectively. Find the height of the poles and the distances of the point from the poles.

Soln:



Let $AB = CD = 'h'$ m
Let $BE = x$
$\Rightarrow ED = 80 - x$

In ΔABE

$$\tan 30° = \frac{AB}{BE}$$

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

$$x = h\sqrt{3}.$$

$$\Rightarrow h = \frac{x}{\sqrt{3}} \rightarrow (1)$$

In ΔCDE,

$$\tan 60° = \frac{CD}{ED}$$

$$\sqrt{3} = \frac{h}{80 - x}$$

$$h = (80 - x)\sqrt{3}. \rightarrow (2)$$

from (1) and (2), $\frac{x}{\sqrt{3}} = (80 - x)\sqrt{3}.$

$$x = (80 - x) \cdot 3$$
$$x = 240 - 3x$$
$$4x = 240$$
$$x = \frac{240}{4}$$
$$= 60$$

$$x = 60\,m$$
$$BE = 60\,m$$
$$ED = 80 - 60$$
$$= 20\,m$$

$$h = \frac{60}{\sqrt{3}}$$
$$= \frac{60}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$
$$= \frac{60\sqrt{3}}{3}$$
$$= 20\sqrt{3}\,m.$$

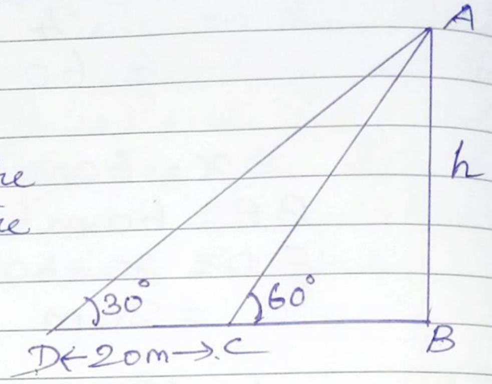
Height of the poles $= 20\sqrt{3}\,m$

Distances of the poles from the point are 60 m, 20 m.

11) A TV tower stands vertically on a bank of a canal. From a point on the other bank directly opposite to the tower, the angle of elevation of the top of the tower is $60°$. From another point 20 m away from this point on the line joining this point to the foot of the tower

the angle of elevation of the top of the tower is $30°$. Find the height of the tower and the width of the canal.

Soln:-



Let $AB = 'h'$ metre
$BD = 'x'$ metre
$BC = BD - CD$
$= x - 20.$

In ΔABC,

$$\tan 60° = \frac{AB}{BC}$$

$$\sqrt{3} = \frac{h}{x-20} \rightarrow (1)$$

In ΔABD,

$$\tan 30° = \frac{AB}{BD}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{x}.$$

$$\Rightarrow h = \frac{x}{\sqrt{3}} \rightarrow (2)$$

from (1) and (2),

$$\sqrt{3} = \frac{\left(\frac{x}{\sqrt{3}}\right)}{x-20}$$

$$= \frac{x}{\sqrt{3}} \times \frac{1}{(x-20)}$$

$$\sqrt{3} = \frac{x}{\sqrt{3}(x-20)}$$

$$3 = \frac{x}{x-20}$$

$$3x - 60 = x$$

$$3x - x = 60$$

$$2x = 60$$

$$x = \frac{60}{2} = 30.$$

$\therefore x = 30$ metre.

$$h = \frac{30}{\sqrt{3}}$$

$$= \frac{30}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

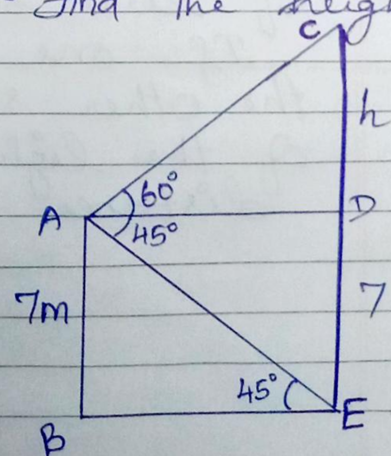
$$= \frac{30\sqrt{3}}{3}$$

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

$BC = x - 20 = 30 - 20 = 10\text{m}$

---

(12) From the top of a 7m high building, the angle of elevation of the top of a cable tower is 60° and the angle of depression of its foot is 45°. Find the height of the tower.



Soln:-

Let $AB = 7m$

$CD = 'h'$ m

$\angle CAD = 60^\circ$

$\angle DAE = 45^\circ$

$\Rightarrow \angle AEB = 45^\circ$ (alt. angle)

Date
Page

~~tan~~ In ΔABE,

$$\tan 45^\circ = \frac{AB}{BE}$$

$$1 = \frac{AB}{BE}$$

$$\Rightarrow AB = BE.$$

$$\therefore BE = 7$$

$$\Rightarrow AD = 7$$

In ΔACD,

$$\tan 60^\circ = \frac{CD}{AD}.$$

$$\sqrt{3} = \frac{h}{7}$$

$$h = 7\sqrt{3}\ m.$$

$$CE = 7\sqrt{3} + 7 = 7(\sqrt{3}+1)\ m.$$

$\therefore$ Height of the tower $= 7(\sqrt{3}+1)m.$

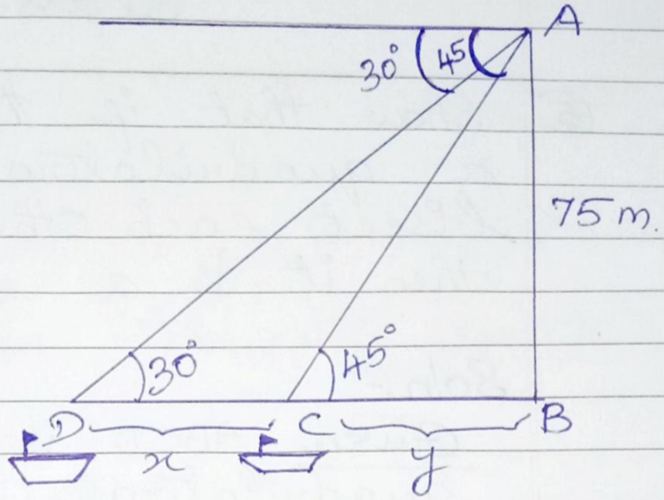
(13) As observed from the top of a 75m high light house from the sea level, the angles of depression of two ships are 30° and 45°. If one ship is exactly behind the other ship on the same side of the light house, find the distance between two ships.

Given

$\angle ADB = 30°$

$\angle ACB = 45°$

To find : x



In ΔABC, $\tan 45° = \frac{AB}{BC}$

$1 = \frac{75}{BC}$

$\Rightarrow BC = 75$

In ΔABD, $\tan 30° = \frac{AB}{BD}$

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

$BD = 75\sqrt{3}$.

$x = DC = BD - BC$

$= 75\sqrt{3} - 75$

$= 75(\sqrt{3} - 1)$ m

$\therefore$ Distance between ships $= 75(\sqrt{3}-$ metr