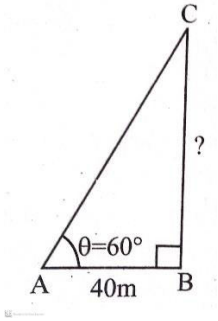
9th Math Exercise No.6.6

Q. 1 The angle of elevation of the top of a flag post from a point on the ground level 40 m away from the flag post is $60°$. Find the height of the post.

Solution



Height of flag post $= m\overline{BC} = ?$

Distance of point from flag post $= m\overline{AB} = 40m$

Angle of elevation $= \theta = 60°$

In right-angled $\triangle ABC$,

$$\tan\theta = \frac{m\overline{BC}}{m\overline{AB}}$$

$$\tan 60° = \frac{mBC}{40}$$

$$\Rightarrow mBC = 40 \times \tan 60°$$

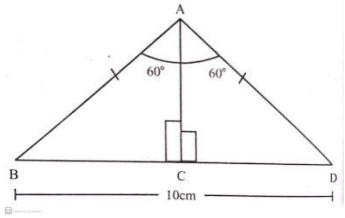
$$mBC = 40 \times \sqrt{3}\ m$$

$$= 69.28\ m$$

So, height of flag post is 69.28 m

Q. 2 An isosceles triangle bas a vertical angle of $120°$ and a base 10 cm long Find the length of its altitude.

Solution:



$\triangle ABD$ is an isosceles triangle with vertical angle $120°$ and base

$$m\overline{BD} = 10\ cm.$$

$\overline{AC}$ is the altitude which bisects vertical angle, as well as base so $m\overline{BC} = m\overline{CD} = 5$ cm m $\overline{AC}$ = ?
In right angle $\triangle ABC$

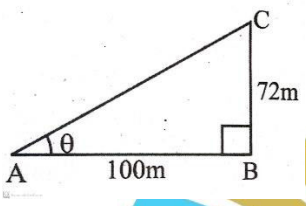
$$\tan 60^\circ = \frac{mBC}{mAC} \left(\because \tan 60^\circ = \sqrt{3}\right)$$

$$\sqrt{3} = \frac{5}{mAC}$$

$$m\overline{AC} = \frac{5}{\sqrt{3}}$$

$$m\overline{AC} = 2.89 \text{ cm}$$

Q. 3 A tree is 72 m high. Find the angle of elevation of its top 100 m away on the ground level.
Solution



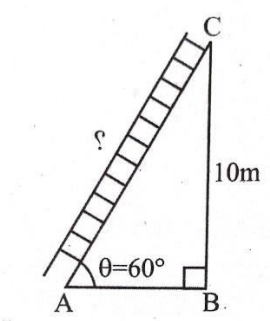
Height of tree $= m\overline{BC} = 72m$
Distance of point from tree $= m\overline{AB} = 100m$
Angle of elevation $= \theta = ?$
As $\tan \theta = \frac{mBC}{mAB}$

$$\tan \theta = \frac{72}{100}$$

$$\theta = \tan^{-1}\left(\frac{72}{100}\right)$$

$$\theta = 35.75^\circ$$

So angle of elevation is 35.75°
Q. 4 A ladder makes an angle of 60° with the ground and reaches a height of 10 m along the wall. Find the length of the ladder.
Solution:



Length of ladder $= \text{m}AC = ?$

Height of wall $= \overline{BC} = 10$ m

Angle made by ladder with ground

$= 7 = 60°$

As $\sin\ \theta = \frac{\text{m}BC}{\text{m}AC}$

$$\sin\ 60° = \frac{\text{ml0}}{\text{m}AC}$$

$$\text{m}\overline{AC} \times \sin\ 60° = 10 \text{ m}$$

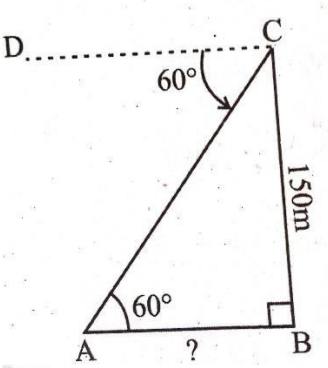
$$\Rightarrow\ \text{m}\overline{AC} = \frac{10}{\sin\ 60°}$$

$$= 11.55 \text{ m}$$

So, Length of ladder is 11.55 m

Q. 5 A light house tower is 150 m high from the sea level. The angle of depression from the top of the tower to a ship is $60°$. Find the distance between the ship and the tower.

Solution



Height of light house tower $= m\overline{BC} = 150m$

Angle of depression to boat $= 60°$

Distance of boat from tower $= \text{m}\overline{AB} =$

As alternate angles of parallel lines are equal, so $\text{m}\angle A = 60°$

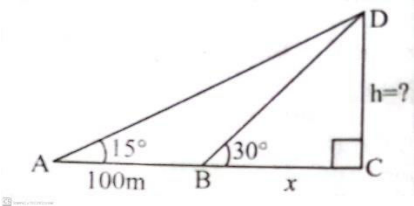
Now $\tan\ 60° = \frac{\text{m}\overline{BC}}{\text{m}AB}$

$$\sqrt{3} = \frac{150}{\text{mAB}}$$
$$\Rightarrow = \sqrt{3} \times \text{m}\overline{\text{AB}} = 150$$
$$\text{m}\overline{\text{AB}} = \frac{150}{\sqrt{3}}$$
$$= 86.60 \text{ m}$$

So, required distance is 86.60 m

Q. 6 Measure of an angle of elevation of the top of a pole is $15°$ from a point on the ground, in walking 100 m towards the pole the measure of angle is found to be $30°$. Find the height of the pole.

Solution:



Height of pole $= \overline{\text{CD}} = \text{h} = ?$

Angles of elevation are

$\text{m}\angle\text{A} = 15°$ and $\text{m}\angle\text{B} = 30°$

$\text{m}\overline{\text{AB}} = 100 \text{ m}$

Left $\text{mBC} = x$

$\text{m}\overrightarrow{\text{AC}} = (x + 100)\text{m}$

In right angle $\triangle$ BCD

$$\tan 30° = \frac{\text{m}\overline{\text{CD}}}{\text{mBC}}$$
$$\frac{1}{\sqrt{3}} = \frac{\text{h}}{x}$$
$$x = \sqrt{3}\,\text{h} \ldots\ldots \text{(i)}$$

In right angle $\triangle ACD$

$$\tan 15° = \frac{\text{m}\overline{\text{CD}}}{\text{mAC}}$$

$$\tan 15^\circ = \frac{h}{100 + x}$$

$$0.268 = \frac{h}{100 + \sqrt{3}h} \text{ ..... from (i)}$$

$$0.268(100 + \sqrt{3}h) = h$$

$$26.8 + 0.464h = h$$

$$26.8 = h - 0.464h$$

$$26.8 = (1 - 0.464)h$$

$$26.8 = 0.536h$$

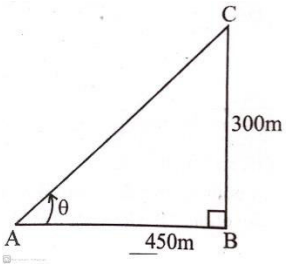
$$h = \frac{26.8}{0.536}$$

$$h = 50m$$

So, height of tower is 50 m .

Q. 7 Find the measure of an angle of elevation of the Sun, if a tower 300 m high casts a shadow 450 m long.

Solution



Height of tower $= m\overline{BC} = 300$ m

$$\tan\theta = \frac{m\overline{BC}}{m\overline{AB}} = \frac{300}{450}$$

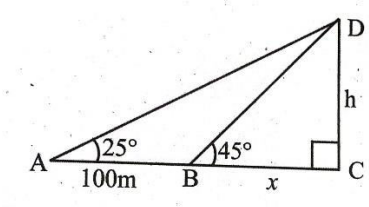
$$\theta = \tan^{-1}\left(\frac{300}{450}\right)$$

$$\theta = 33.69^\circ$$

So, angle of elevation of sun is 33.69°

Q. 8 Measure of angle of elevation of the top of a cliff is 25°, on walking 100 metres towards the cliff, measure of angle of elevation of the top is 45°. Find the height of the cliff.

Solution



From the figure

Height of cliff $= \overline{\mathrm{CD}} = \mathrm{h} = ?$

Angles of elevation are:

$$\mathrm{m}\angle \mathrm{A} = 25^\circ$$
$$\mathrm{m}\angle \mathrm{B} = 45^\circ$$

Let $\mathrm{m}\overline{\mathrm{BC}} = x$

$$\mathrm{m}\overline{\mathrm{AC}} = 100 + x$$

In right angle $\triangle \mathrm{BCD}$

$$\tan 45^\circ = \frac{\overline{\mathrm{CD}}}{\overline{\mathrm{BC}}}$$
$$1 = \frac{\mathrm{h}}{x}$$
$$x = \mathrm{h} \cdots\cdots\cdots \text{(i)}$$

In right angle $\triangle \mathrm{ACD}$

$$\tan 25^\circ = \frac{\overline{\mathrm{CD}}}{\overline{\mathrm{AC}}}$$
$$\tan 25^\circ = \frac{\mathrm{h}}{100 + x}$$
$$0.466 = \frac{\mathrm{h}}{100 + \mathrm{h}} \text{ from (i)}$$

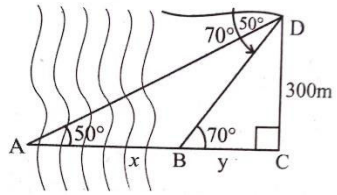
$0.466 = \frac{h}{100+h}$ from (i)

$$0.466^\circ(100 + h) = h$$
$$46.6^\circ + 0.466h = h$$
$$46.6^\circ = h - 0.466h$$
$$46.6^\circ = (1 - 0.466)h$$
$$46.6^\circ = 0.534h$$
$$h = \frac{46.6}{0.534}$$
$$h = 87.27m$$

So, height of cliff is 87.27 m .

Q. 9 From the top of a hill 300 m high, the measure of the angle of depression of a point on the nearer shore of the river is 70° and measure of the angle of depression of a point, directly across the river is 50°. Find the width of the river How far is the river from the foot of the hill?

Solution:



Height of hill $= \mathrm{D} = 300\ \mathrm{m}$

Angles of depression of two shores from top of hill are $70°$ and $50°$ respectively.

As alternate angles of parallel lines are equal so $\mathrm{m}\angle\mathrm{A} = 50°$ and $\mathrm{m}\angle\mathrm{B} = 70°$

Width of river $= \overline{\mathrm{AB}} = x$

Let distance of river from cliff $= \overline{\mathrm{BC}} = \mathrm{y} = ?$

In right angle $\triangle\,\mathrm{BCD}$

$$\tan\ 70° = \frac{\overline{CD}}{\overline{BC}}$$

$$\tan\ 70° = \frac{300}{y}$$

$$y = \frac{300}{\tan\ 70°}$$

$$y = 109.19\ \mathrm{m}$$

In right angle $\triangle\,ACD$

$$\tan\ 50° = \frac{\mathrm{mCD}}{\mathrm{mAC}}$$

$$\Rightarrow \tan\ 50° = \frac{300}{x + y}$$

$$\tan\ 50° = \frac{300}{x + y}$$

$$(x + y)\tan\ 50° = 300°$$

$$x + y = \frac{300}{\tan\ 50°}$$

$$x + y = 251.7$$

$$x = 251.7 - y$$

$$x = 251.7 - 109.19$$

$$x = 142.51$$

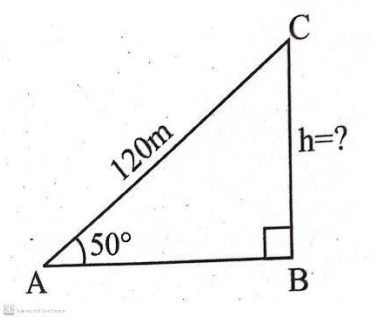
$$\Rightarrow\ \mathrm{m}\overline{\mathrm{AB}} = 142.51$$

So, width of river is 142.5 m and distance of rive from cliff is 109.19 m

Q. 10 A kite has 120 m of string attached to it when at an elevation of

$50°$. How far is it above the hand holding it? (Assume that the string is tight.

Solution



Length of string $= \overline{AC} = 120$ m

Angle of elevation $= \theta = 50°$

Height above $= \overline{BC} = h = ?$

As $\sin 50° = \frac{BC}{AC}$

$$\text{Sin}50° = \frac{h}{120}$$

$$120 \times \sin 50° = h$$

$$120 \times 0.766 = h$$

$$91.92 = h$$

$$\Rightarrow h = 91.92 \text{ m}$$

$$= 91.92 \text{ m}$$

So, required altitude is 91.92 m .