10TH CLASS

APPLICATIONS OF TRIGONOMETRY

Pdf version with video links

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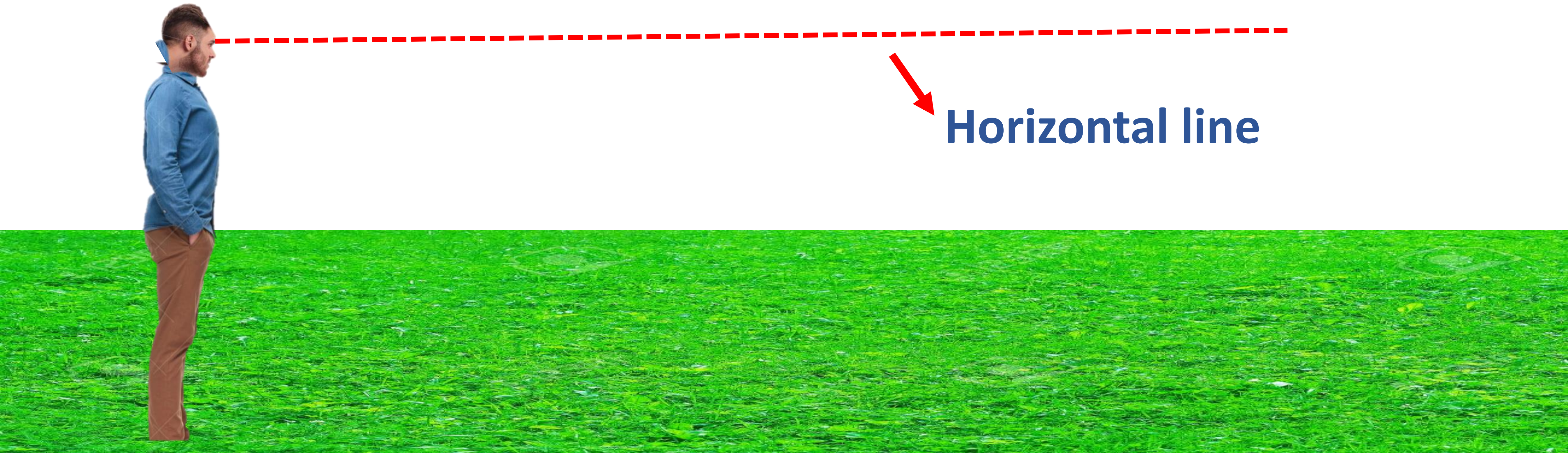
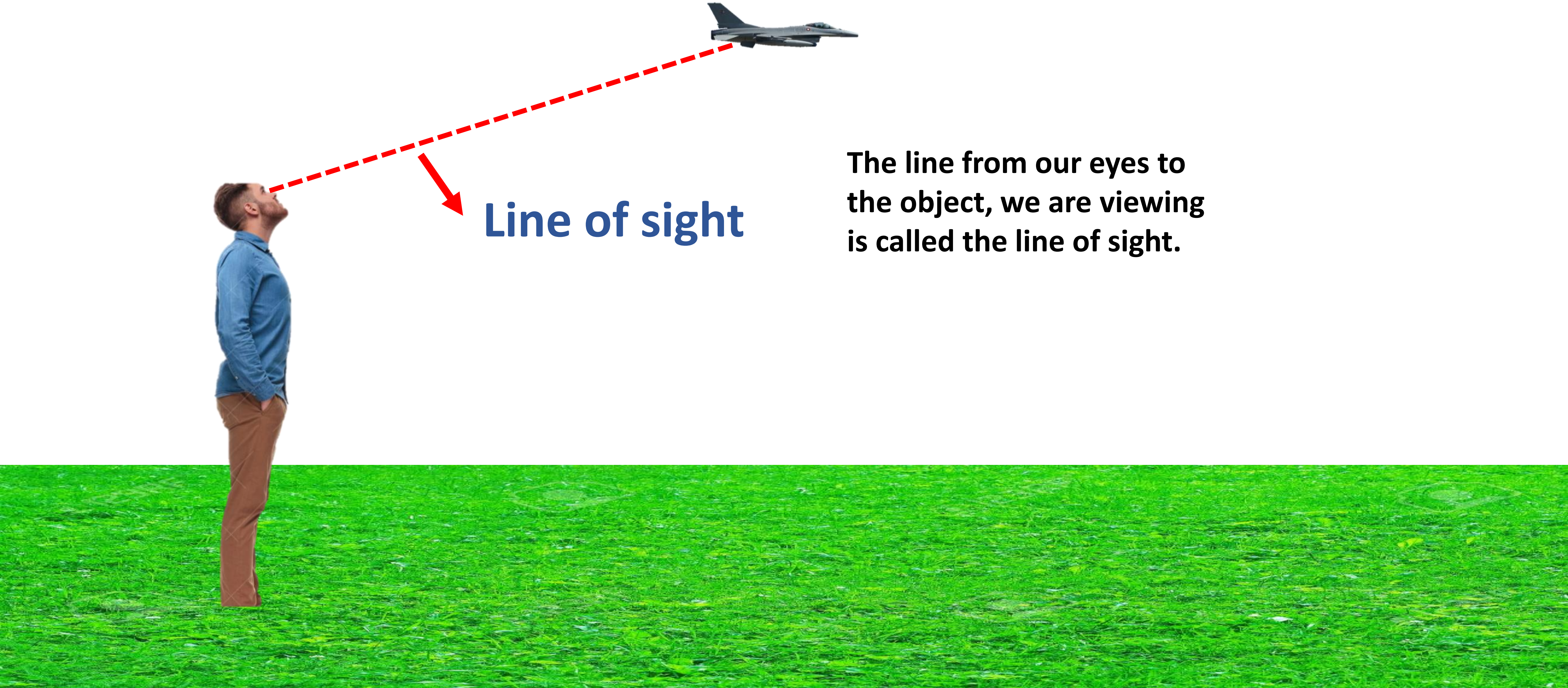
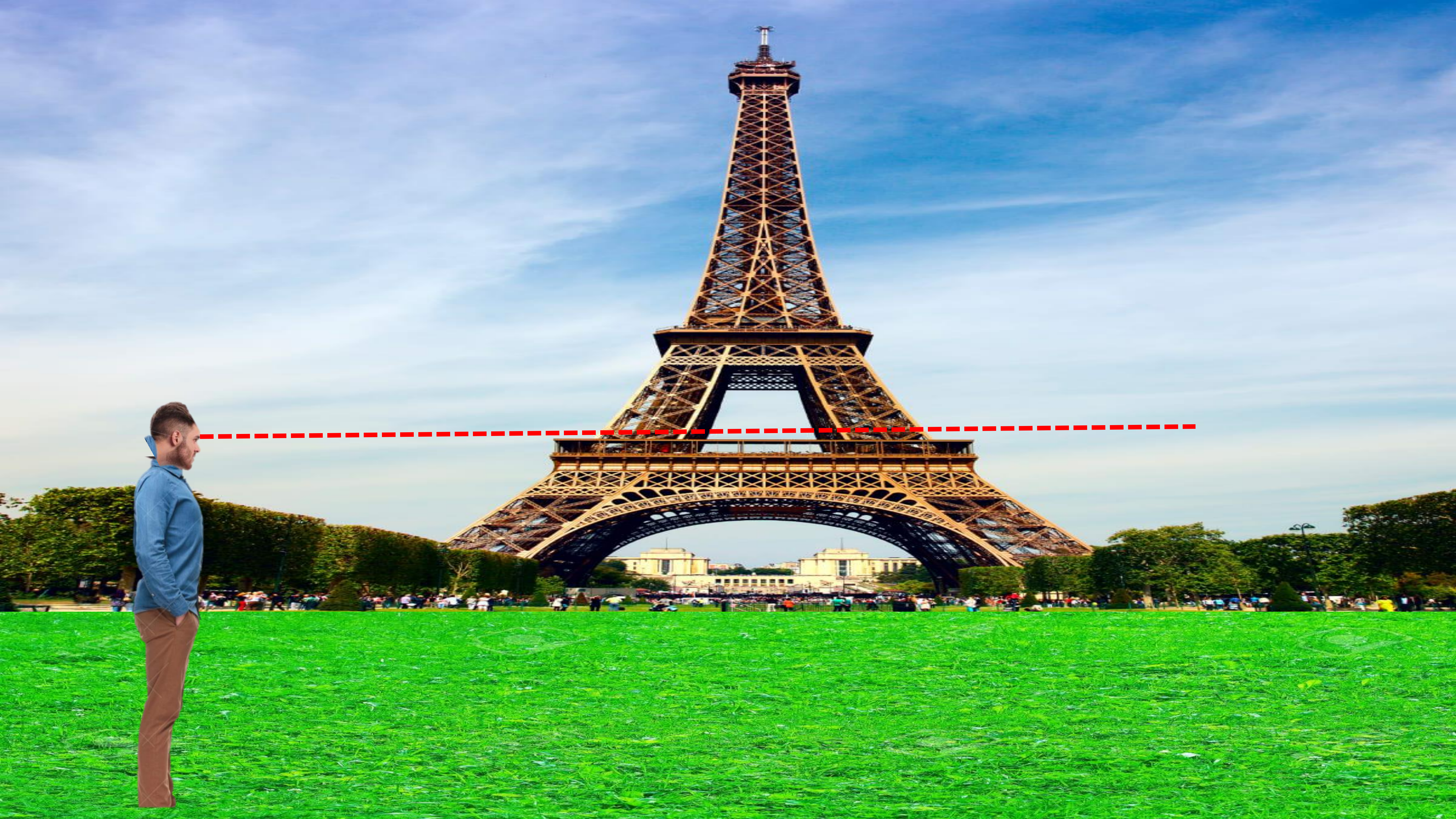
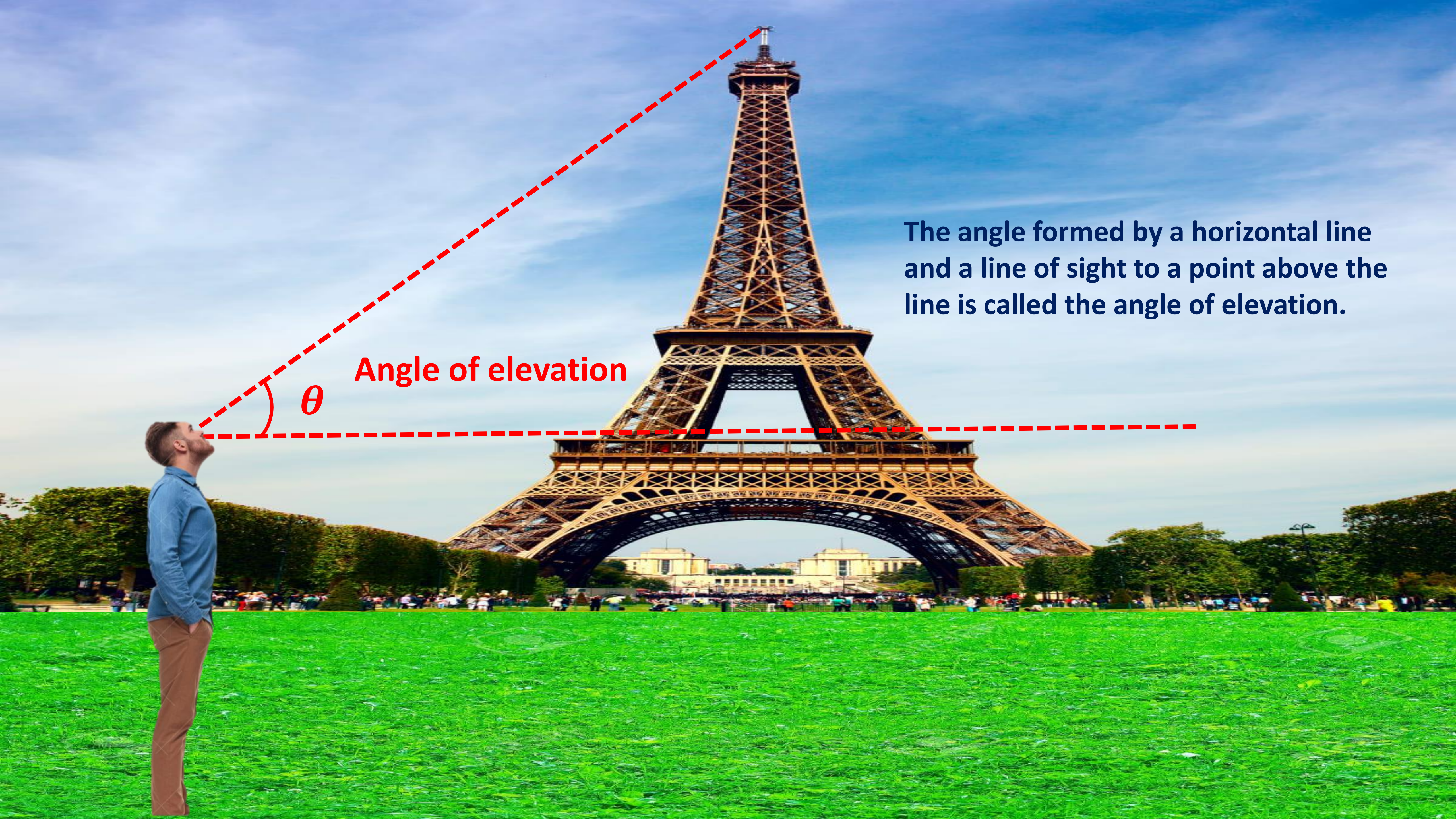
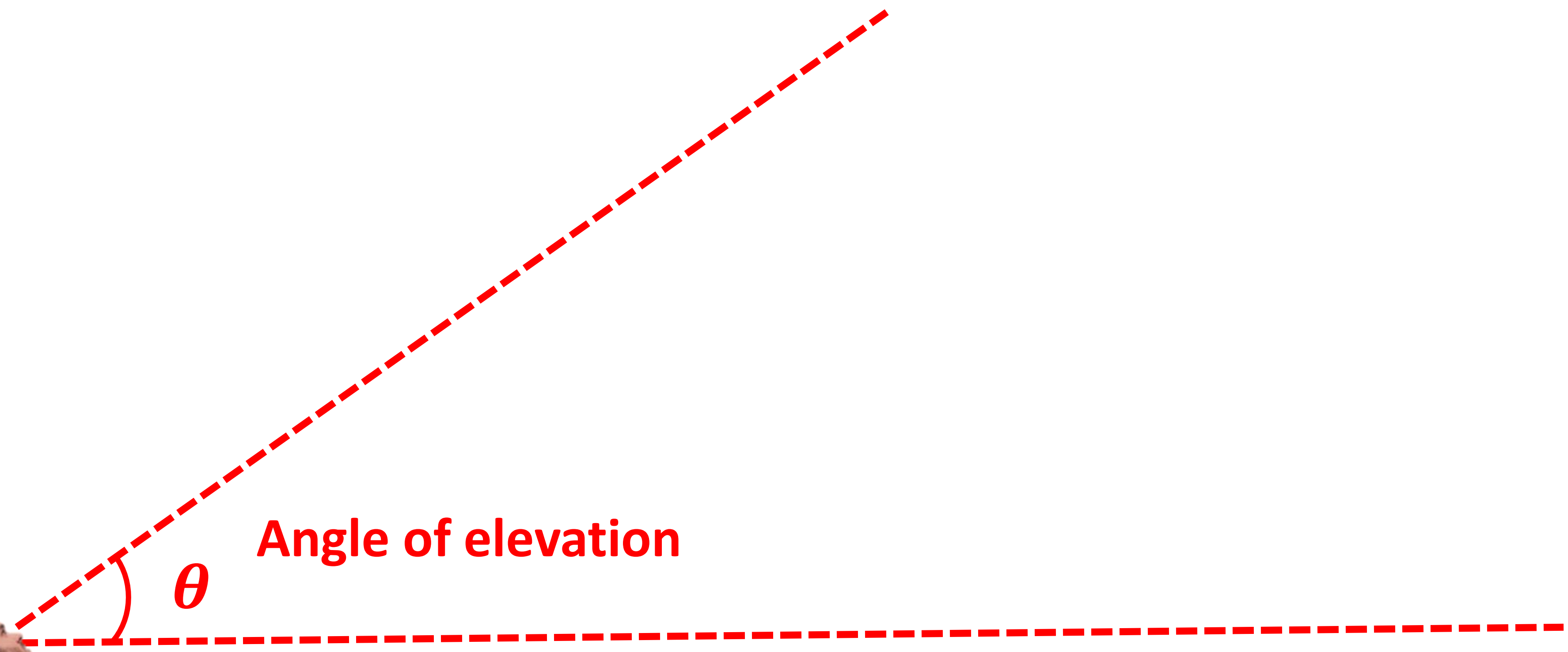




The line from our eyes to the object, we are viewing is called the line of sight.




The angle formed by a horizontal line and a line of sight to a point above the line is called the angle of elevation.
Angle of elevation
θ



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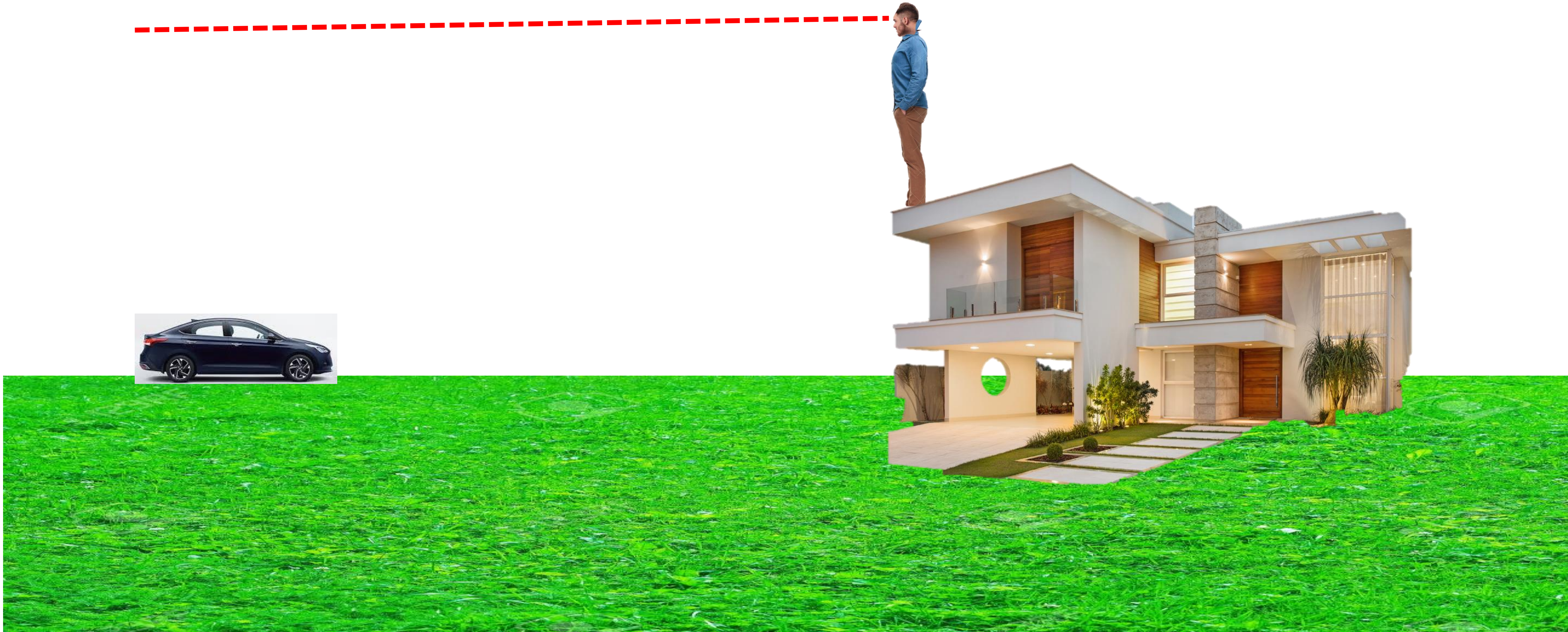
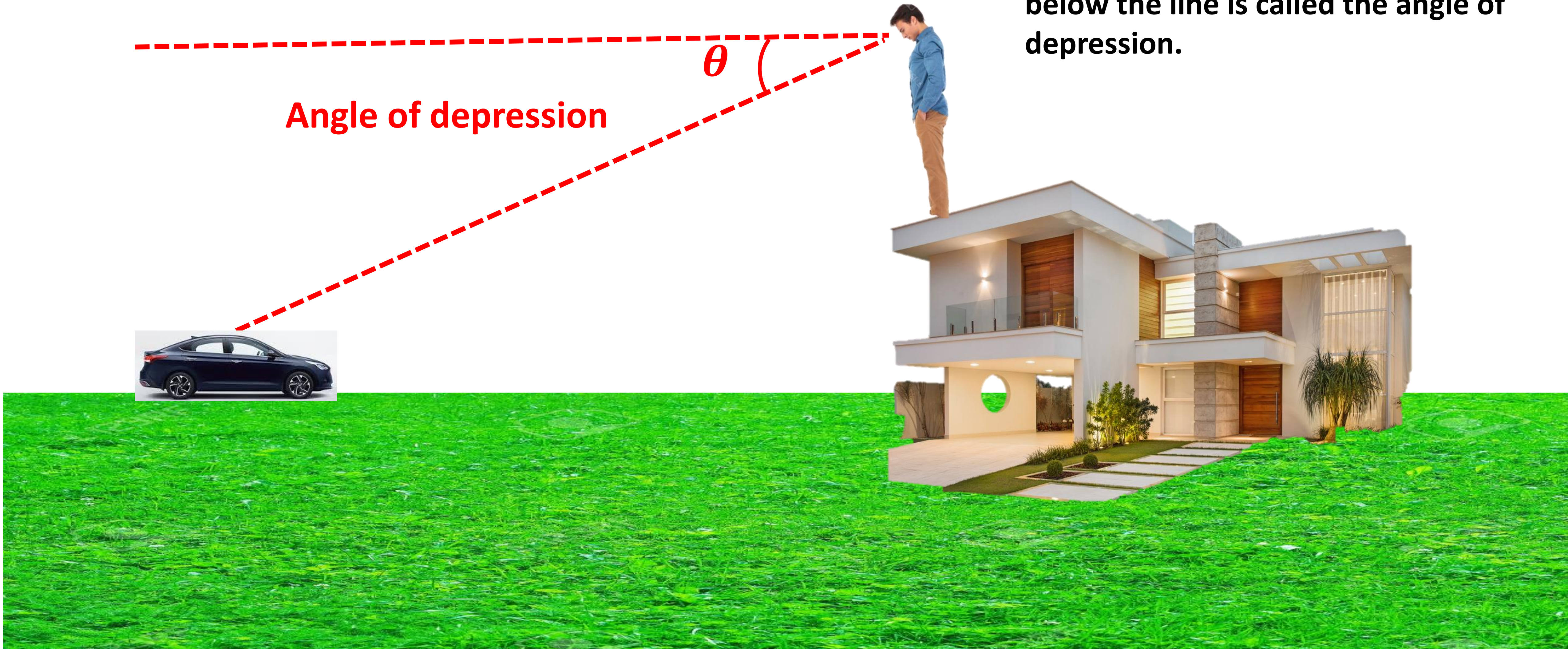
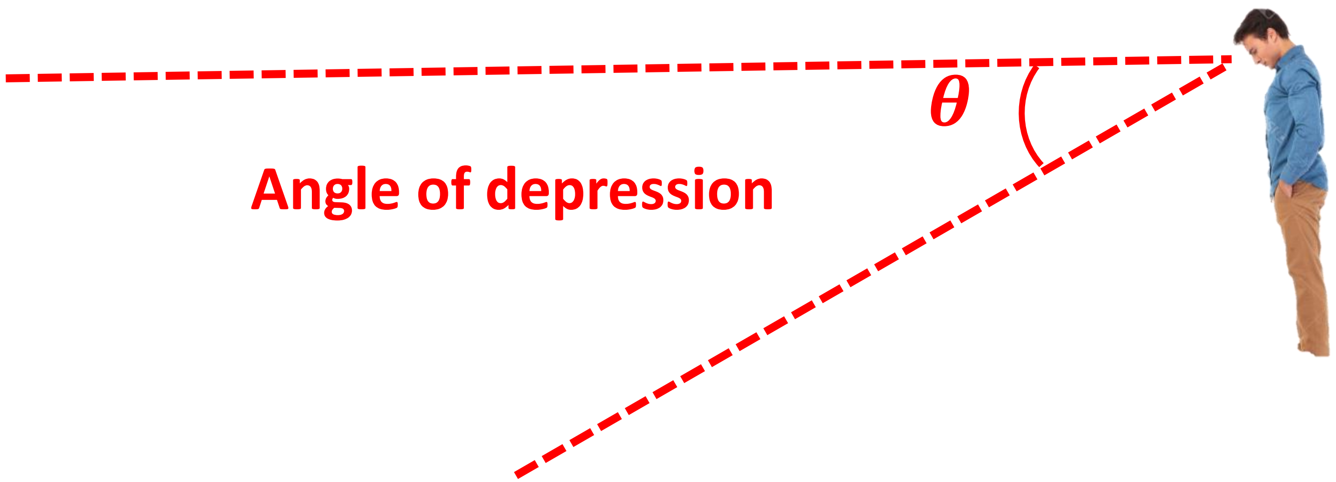




The angle formed by a horizontal line and a line of sight to a point below the line is called the angle of depression.



The angle formed by a horizontal line and a line of sight to a point below the line is called the angle of depression.

When we want to solve the problems of heights and distances, we should consider the following:

(i) All the objects such as towers, trees, buildings, ships, mountains etc. shall be considered as linear for mathematical convenience.

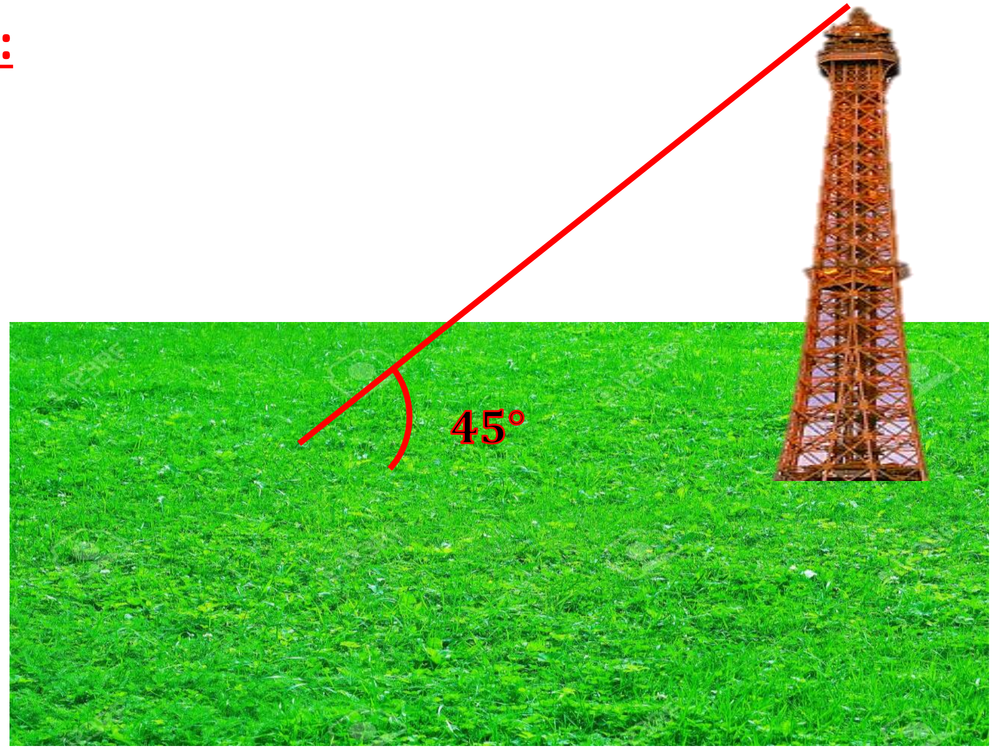
(ii) The angle of elevation or angle of depression is considered with reference to the horizontal line.

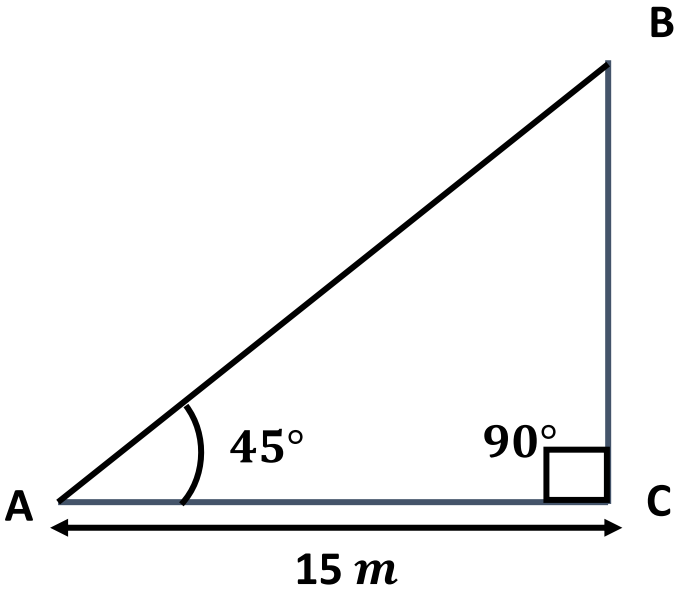
(iii) The height of the observer is neglected, if it is not given in the problem.

EXERCISE – 12.1

1) A tower stands vertically on the ground. From a point which is 15 meter away from the foot of the tower, the angle of elevation of the top of the tower is 45°. What is the height of the tower?

Sol:





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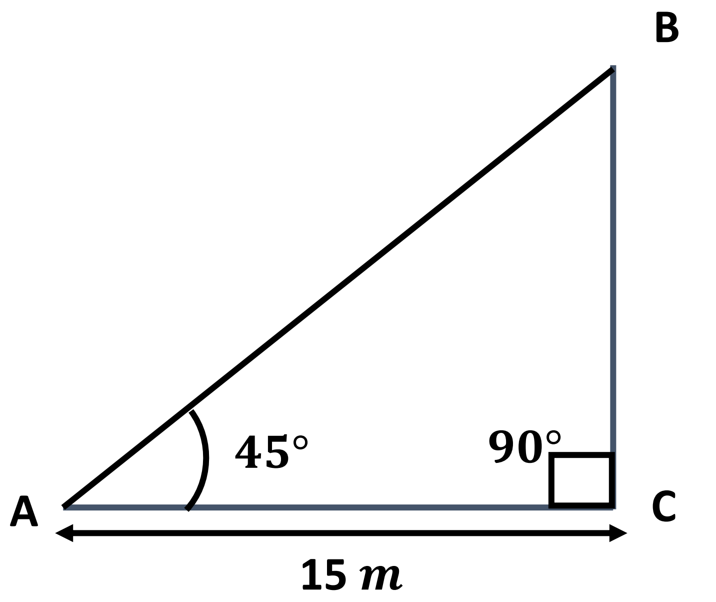


Sol: Let 'A' be the observation point and 'BC' be the height of the tower.

$$\angle BAC = 45°$$

$$AC = 15m$$

From ΔABC,

$$tanA = \frac{BC}{AC}$$

$$tan45° = \frac{BC}{15}$$

$$1 = \frac{BC}{15}$$

$$BC = 15$$

$\therefore$ The height of the tower = 15 m

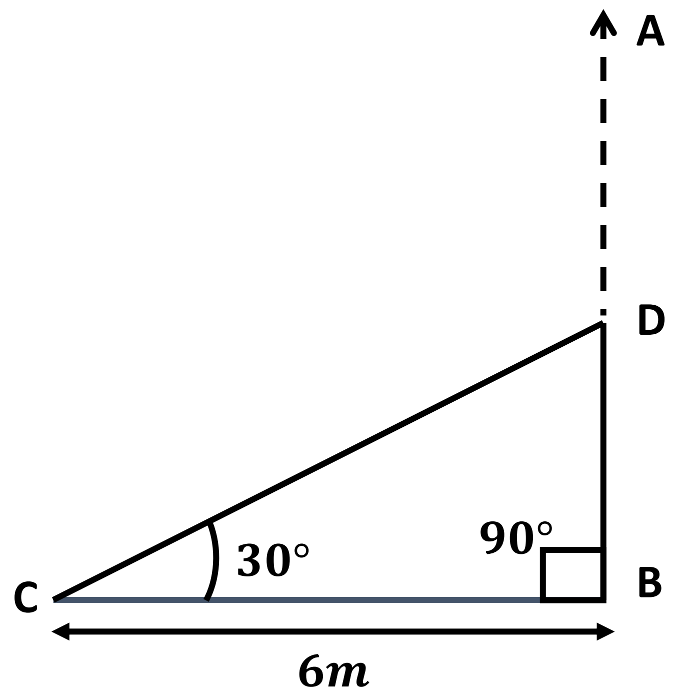
2. A tree breaks due to storm and the broken part bends so that the top of the tree touches the ground by making 30° angle with the ground. The distance between the foot of the tree and the top of the tree on the ground is 6m. Find the height of the tree before falling down.

Sol: Let '*A*' be the top of the tree and

B - bottom of the tree.

D - the point at which tree broke

C - the point at which broken part touch the ground



$\angle DCB = 30°$ $BC = 6m$ $AD = DC$

From ΔDBC, $tanC = \frac{DB}{BC}$

$tan30° = \frac{DB}{6}$

$\frac{1}{\sqrt{3}} = \frac{DB}{6}$

$DB = \frac{6}{\sqrt{3}}$

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

$cos30° = \frac{6}{DC}$

$\frac{\sqrt{3}}{2} = \frac{6}{DC}$

$DC = \frac{12}{\sqrt{3}}$

The height of the tree before falling down

= AD + DB = DC + DB

$= \frac{6}{\sqrt{3}} + \frac{12}{\sqrt{3}}$

$= \frac{18}{\sqrt{3}}$

$= \frac{6\times3}{\sqrt{3}}$

$= \frac{6\times(\sqrt{3})^2}{\sqrt{3}}$

$= 6\sqrt{3}$

∴ The height of the tree before falling down = $6\sqrt{3}\ m$

3. A contractor wants to set up a slide for the children to play in the park. He wants to set it up at the height of 2 m and by making an angle of 30° with the ground. What should be the length of the slide?

Sol: Let AB – height of the slide

AC – length of the slide

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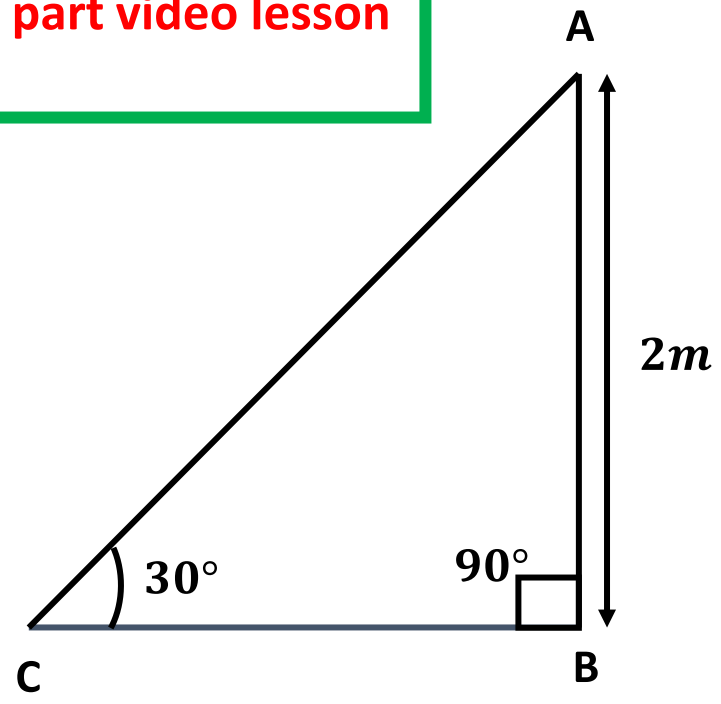


$\angle ACB = 30^\circ \qquad AB = 2m$

From ΔABC, $\quad sinC = \dfrac{AB}{AC}$

$$sin30^\circ = \frac{2}{AC}$$

$$\frac{1}{2} = \frac{2}{AC}$$

$$AC = 4$$

$\therefore$ *The length of the slide should be 4m*

4. Length of the shadow of a 15 meter high pole is $15\sqrt{3}$ meters at 8 O'clock in the morning. Then, what is the angle of elevation of the Sun rays with the ground at the time?

Sol:

Let AB – height of the pole

BC – length of the shadow

Let 'θ' be the angle of elevation of sunrays.

$\angle ACB = \theta \qquad AB = 15m \qquad BC = 15\sqrt{3}\ m$

From ΔABC, $\quad tanC = \dfrac{AB}{BC}$

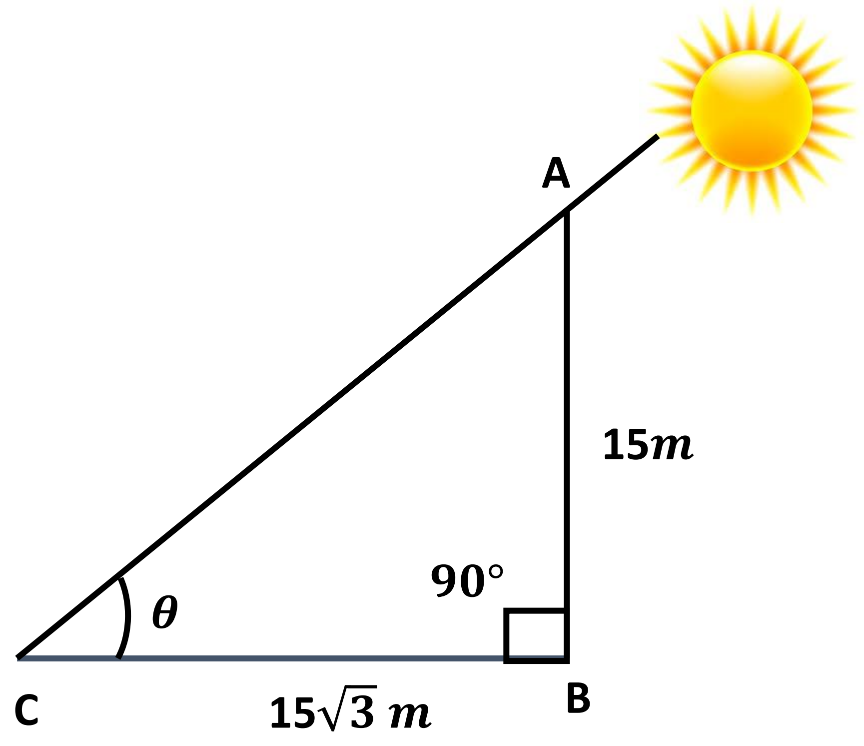
$$tan\theta = \frac{15}{15\sqrt{3}}$$

$$tan\theta = \frac{1}{\sqrt{3}}$$

$$tan\theta = tan30°$$

$$\theta = 30°$$

$\therefore$ *The angle of elevation of sunrays is* $30°$



5. You want to erect a pole of height 10 m with the support of three ropes. Each rope has to make an angle 30° with the pole. What should be the length of the rope?

Sol: Let AB – height of the pole

AC – length of the rope

$\angle BAC = 30°$ $\quad AB = 10\ m$

From ΔABC, $\quad cosA = \dfrac{AB}{AC}$

$$cos30° = \frac{10}{\text{AC}}$$

$$\frac{\sqrt{3}}{2} = \frac{10}{\text{AC}}$$

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

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

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

Length of each rope = $\dfrac{20\sqrt{3}}{3}m$

Sum of the lengths of the three ropes

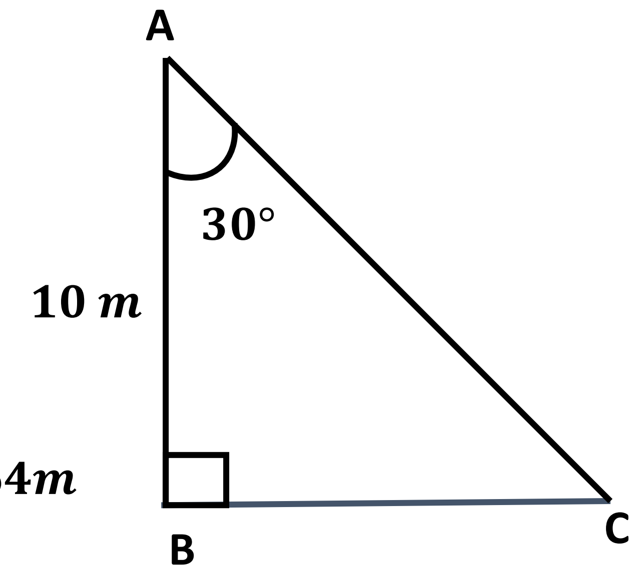
$$= \frac{20\sqrt{3}}{3} \times 3$$

$$= 20\sqrt{3}$$

$$= 20 \times 1.732$$

$$= 34.64$$

$\therefore$ *The length of the rope should be* $34.64m$



6. Suppose you are shooting an arrow from the top of a building at an height of 6 m to a target on the ground at an angle of depression of 60°. What is the distance between you and the object?

Sol: Let AB – height of the building

C – the target

AD – horizontal line

AC = distance between me and the object

$$\angle DAC = 60^\circ \quad \Rightarrow \angle ACB = 60^\circ \quad (\because \textit{Alternate angles are equal})$$

$$AB = 6\ m$$

From ΔABC, $\quad sinC = \dfrac{AB}{AC}$

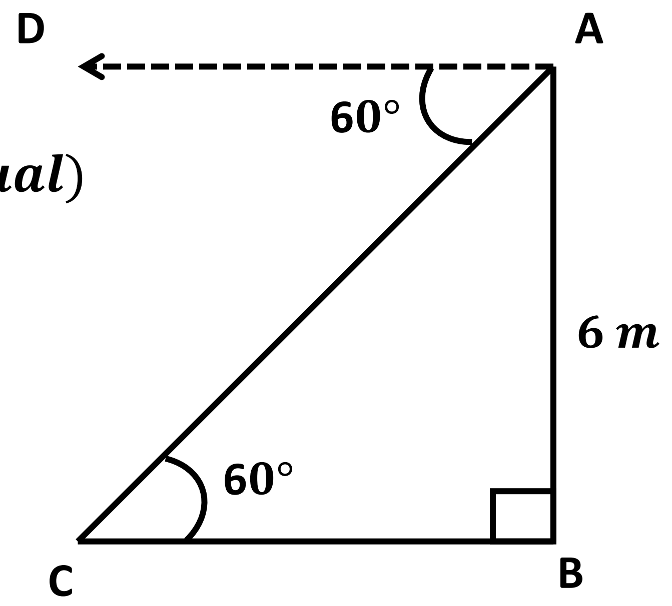
$$sin60^\circ = \frac{6}{AC}$$

$$\frac{\sqrt{3}}{2} = \frac{6}{AC}$$

$$AC = \frac{12}{\sqrt{3}}$$

$$AC = \frac{4 \times 3}{\sqrt{3}} = 4\sqrt{3}$$

$\therefore$ *The distance between me and the object is* $4\sqrt{3}\ m$



7. An electrician wants to repair an electric connection on a pole of height 9 m. He needs to reach 1.8 m below the top of the pole to do repair work. What should be the length of the ladder which he should use, when he climbs it at an angle of 60° with the ground? What will be the distance between foot of the ladder and foot of the pole?

Sol: Let AB – height of the pole

BC – distance between the foot of the pole and foot of the ladder

D – the point at which the pole to be repaired

CD – length of the ladder

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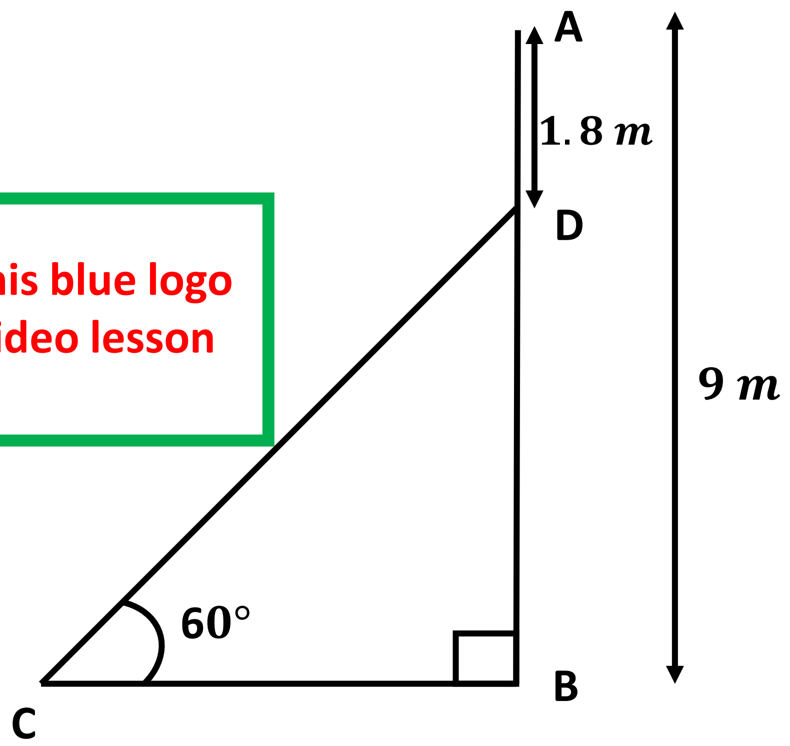


$\angle DCB = 60°$ $\quad AB = 9\,m$ $\quad AD = 1.8\,m$

$BD = AB - AD = 9 - 1.8 = 7.2\,m$

From ΔBDC, $\quad sinC = \dfrac{BD}{CD}$

$$sin60° = \frac{7.2}{CD}$$

$$\frac{\sqrt{3}}{2} = \frac{7.2}{CD}$$

$$CD = \frac{7.2 \times 2}{\sqrt{3}}$$

$$CD = \frac{2.4 \times 3 \times 2}{\sqrt{3}}$$

$$CD = 2.4 \times \sqrt{3} \times 2$$

$$CD = 4.8\sqrt{3}$$

similarly,

$$tanC = \frac{BD}{BC}$$

$$tan60° = \frac{7.2}{BC}$$

$$\sqrt{3} = \frac{7.2}{BC}$$

$$BC = \frac{7.2}{\sqrt{3}}$$

$$BC = \frac{2.4 \times 3}{\sqrt{3}}$$

$$BC = 2.4 \times \sqrt{3}$$

$$BC = 2.4 \times 1.732$$

$$BC = 4.1568$$

$\therefore$ *The length of the ladder should be* $4.8\sqrt{3}\,m$ *and the distance between foot of the ladder and the foot of the pole is* $4.1568\,m$

8. A boat has to cross a river. It crosses the river by making an angle of 60° with the bank of the river due to the stream of the river and travels a distance of 600m to reach the another side of the river. What is the width of the river?

<u>Sol:</u> Let AB – width of the river

AC – distance travelled by the boat

Draw a parallel line CD to AB

$$CD = AB$$

$\angle DAC = 60°$ $\quad AC = 600\ m$

From ΔACD, $\quad sinA = \dfrac{CD}{AC}$

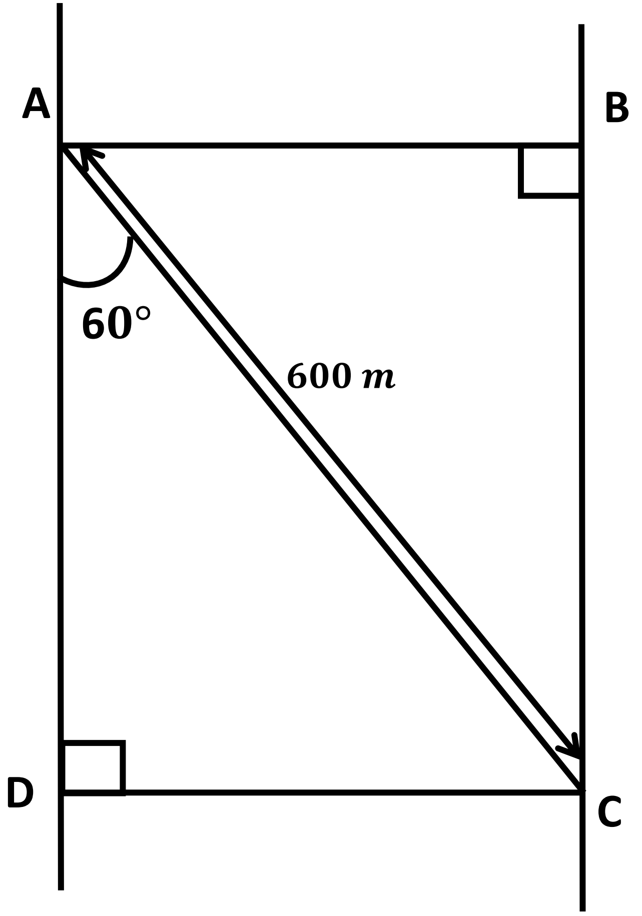
$$sin60° = \frac{AB}{600}$$

$$\frac{\sqrt{3}}{2} = \frac{AB}{600}$$

$$AB = \frac{600\sqrt{3}}{2}$$

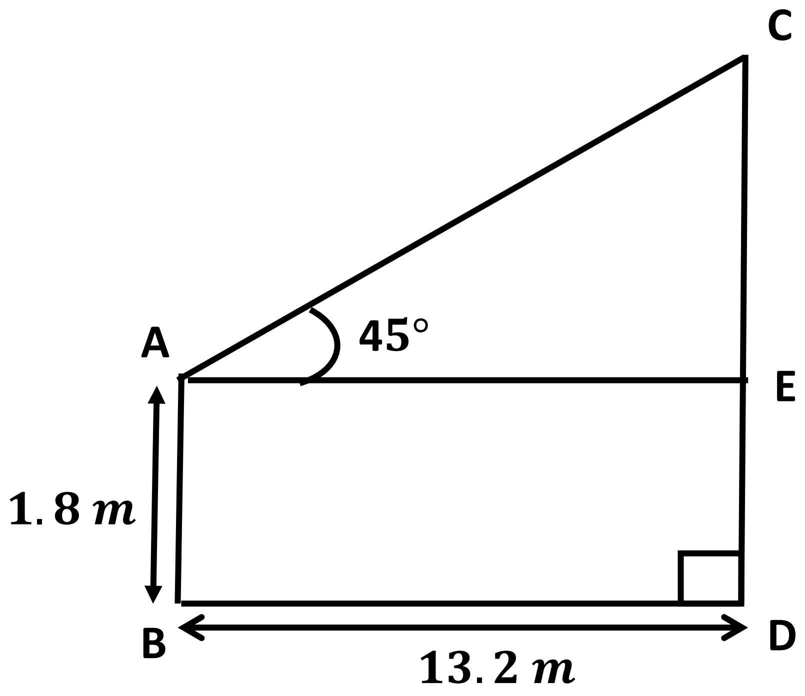
$$AB = 300\sqrt{3}$$

$\therefore$ *The width of the river is* $300\sqrt{3}\ m$



9. An observer of height 1.8 m is 13.2 m away from a palm tree. The angle of elevation of the top of the tree from his eyes is 45°. What is the height of the palm tree?

Sol: Let AB – Height of the observer
CD – height of the palm tree
BD – distance from observer to the tree
AE – horizontal line



$$\angle CAE = 45^\circ \qquad AB = ED = 1.8\ m$$

$$AE = BD = 13.2\ m$$

From ΔAEC, $tanA = \frac{CE}{AE}$

$$tan45^\circ = \frac{CE}{13.2}$$

$$1 = \frac{CE}{13.2}$$

$$CE = 13.2$$

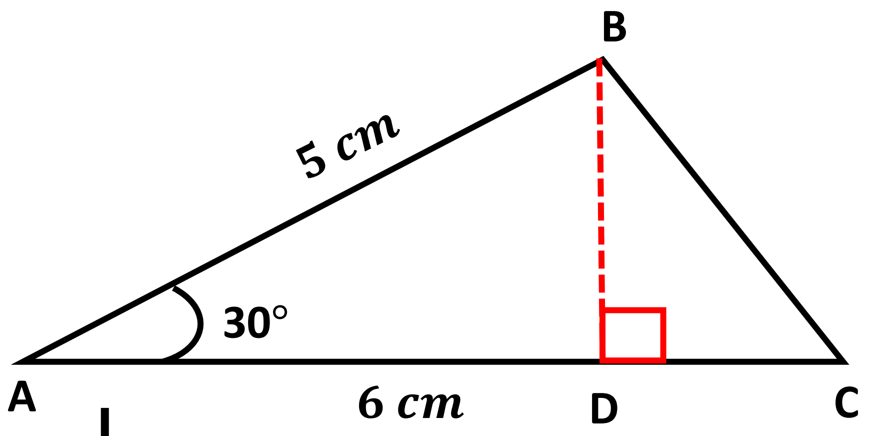
Now, $CD = CE + ED$

$$= 13.2 + 1.8$$

$$= 15$$

$\therefore$ *The height of the palm tree is* $15\ m$

10. In the adjacent figure, AC = 6 cm, AB = 5 cm and ∠ BAC = 30°. Find the area of the triangle.



Sol: In the given figure,

$$AB = 5\ cm$$

$$AC = 6\ cm$$

$$\angle BAC = 30°$$

Draw a perpendicular line BD from B to AC

In ΔABD, $\quad sinA = \frac{BD}{AB}$

$$sin30° = \frac{BD}{5}$$

$$\frac{1}{2} = \frac{BD}{5}$$

$$BD = \frac{5}{2}$$

For ΔABC, $\quad base\ AC = 6\ cm$ and $\quad height\ BD = \frac{5}{2}\ cm$

Area of ΔABC $= \frac{1}{2} \times AC \times BD$

$$= \frac{1}{2} \times 6 \times \frac{5}{2}$$

$$= 3 \times 2.5$$

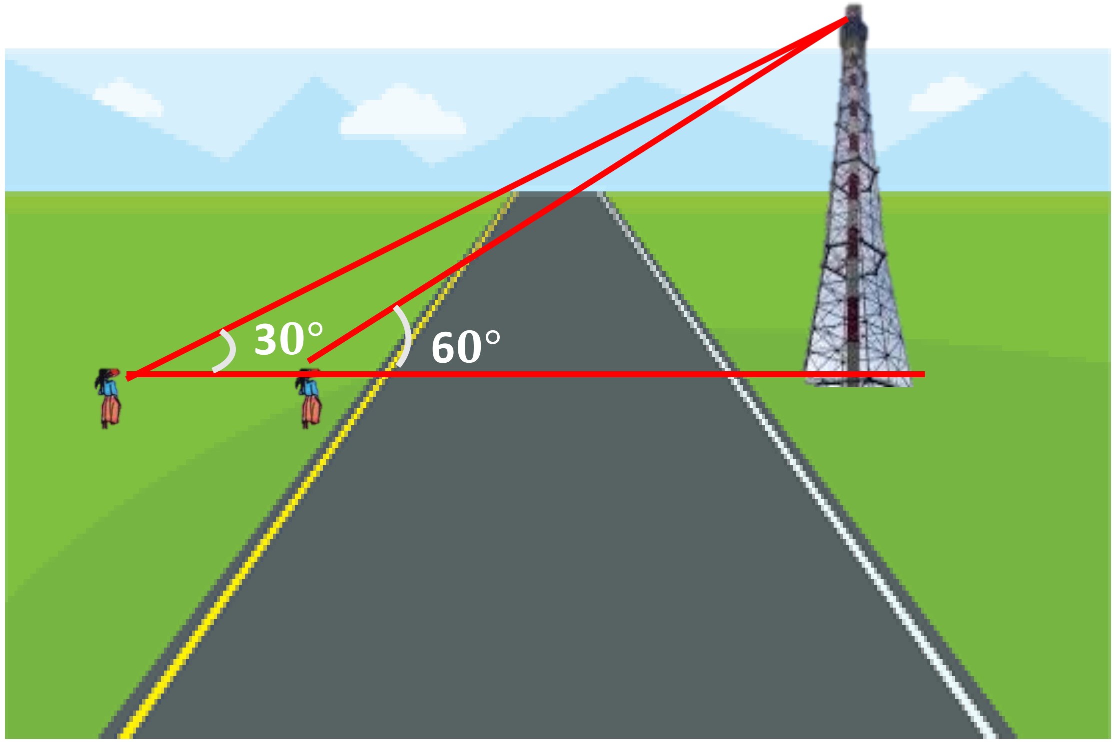
$$= 7.5$$

$\therefore The\ area\ of\ given\ triangle\ is\ 7.5\ sq.cm$

EXERCISE – 12.2

1. A TV tower stands vertically on the side of a road. From a point on the other side directly opposite to the tower, the angle of elevation of the top of tower is $60°$. From another point 10 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 road.

Sol:



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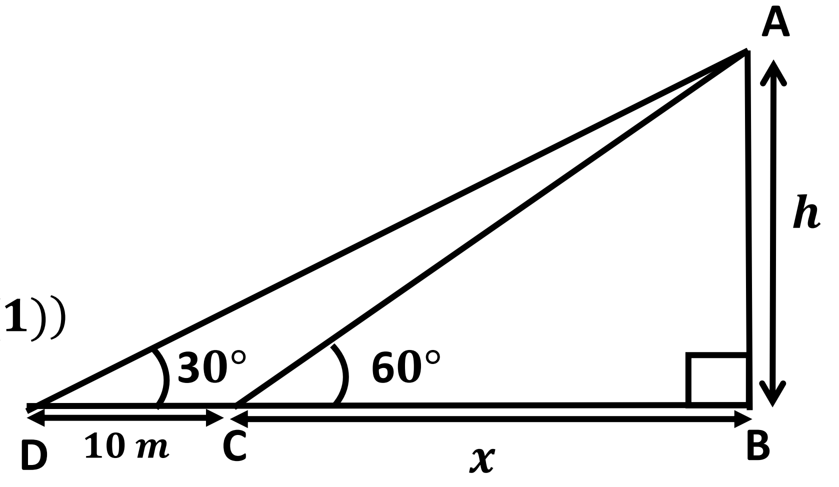
1. **A TV tower stands vertically on the side of a road. From a point on the other side directly opposite to the tower, the angle of elevation of the top of tower is 60° . From another point 10 m away from this point, on the line joining this point to the foot of the tower, the angle of elevation of the top of the tower is 30°. Find the height of the tower and the width of the road.**

Sol: Let AB – Height of the tower = 'h' m

BC – width of the road = 'x' m

C and D are points of observation

Given $\angle ACB = 60°$ $\angle ADB = 30°$ $CD = 10\ m$



From ΔABC, $tanC = \frac{AB}{BC}$

$$tan60° = \frac{h}{x}$$

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

$$h = x\sqrt{3} \longrightarrow (1)$$

From ΔABD, $tanD = \frac{AB}{BD} = \frac{AB}{BC + CD}$

$$tan30° = \frac{h}{x + 10}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{x + 10}$$

$$\frac{1}{\sqrt{3}} = \frac{x\sqrt{3}}{x + 10} \quad (From\ Eq.(1))$$

$$x + 10 = x\sqrt{3}(\sqrt{3})$$

$$x + 10 = 3x$$

$$3x - x = 10$$

$$2x = 10$$

$$x = \frac{10}{2} = 5$$

$From\ Eq.(1),$

$$h = x\sqrt{3} = 5\sqrt{3}$$

$\therefore$ *The height of the tower is* $5\sqrt{3}\ m$ *and the width of the road is* $5\ m$

2. A 1.5 m tall boy is looking at the top of a temple which is 30 meter in height from a point at certain distance. The angle of elevation from his eye to the top of the crown of the temple increases from 30° to 60° as he walks towards the temple. Find the distance he walked towards the temple.

Sol: AB – Height of the tower = 30 m

CD – height of the boy = 1.5 m

CE – horizontal line

C and F are points of observation

Given $\angle ACE = 30°$ $\quad \angle AFE = 60°$

$AB = 30\,m \quad CD = EB = 10\,m$

Let EF = $'x'\,m$ and CF = $'y'\,m$

$AE = AB - EB = 30 - 1.5 = 28.5\,m$

From ΔAEF, $\tan F = \dfrac{AE}{EF}$

$$\tan 60° = \frac{28.5}{x}$$

$$\sqrt{3} = \frac{28.5}{x}$$

$$x = \frac{28.5}{\sqrt{3}} \longrightarrow (1)$$

From ΔAEC, $\tan C = \dfrac{AE}{EC}$

$$\tan 30° = \frac{28.5}{EF + FC}$$

$$\frac{1}{\sqrt{3}} = \frac{28.5}{x+y}$$

$$x + y = 28.5(\sqrt{3})$$

$$\frac{28.5}{\sqrt{3}} + y = 28.5(\sqrt{3}) \; (From\ Eq.(1))$$

$$y = 28.5(\sqrt{3}) - \frac{28.5}{\sqrt{3}}$$

$$y = \frac{28.5(\sqrt{3})^2 - 28.5}{\sqrt{3}}$$

$$y = \frac{28.5(3) - 28.5}{\sqrt{3}}$$

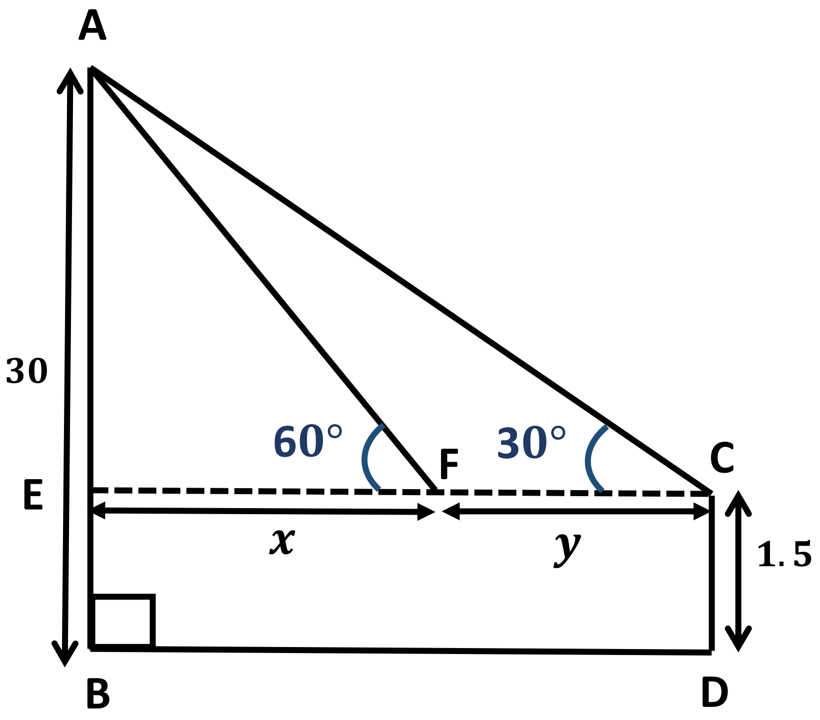
$$y = \frac{85.5 - 28.5}{\sqrt{3}}$$

$$y = \frac{57}{\sqrt{3}}$$

$$y = \frac{19 \times 3}{\sqrt{3}}$$

$$y = 19\sqrt{3} = 19 \times 1.732 = 32.908\,m$$

$\therefore$ *The distance walked by the boy towards the temple is* $32.908\,m$



3. A statue stands on the top of a 2m tall pedestal. From a point on the ground, the angle of elevation of the top of 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 statue

<u>Sol:</u> Let

AB – Height of the statue = ‘h’m

BC – height of the pedestal = 2 m

D – point of observation

Given $\angle ADC = 60°$ $\angle BDC = 45°$

From ΔBCD, $tan45° = \dfrac{BC}{CD}$

$$1 = \frac{2}{CD}$$

$$CD = 2\ m$$

From ΔACD, $tan60° = \dfrac{AC}{CD}$

$$\sqrt{3} = \frac{h+2}{2}$$

$$h + 2 = 2\sqrt{3}$$

$$h = 2\sqrt{3} - 2$$

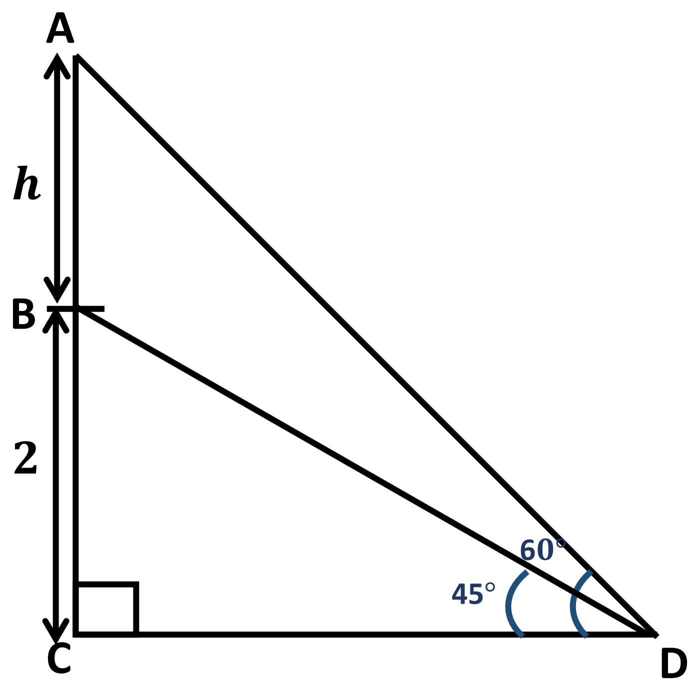
$$h = 2(\sqrt{3} - 1)$$

$$= 2(1.732 - 1)$$

$$= 2(0.732)$$

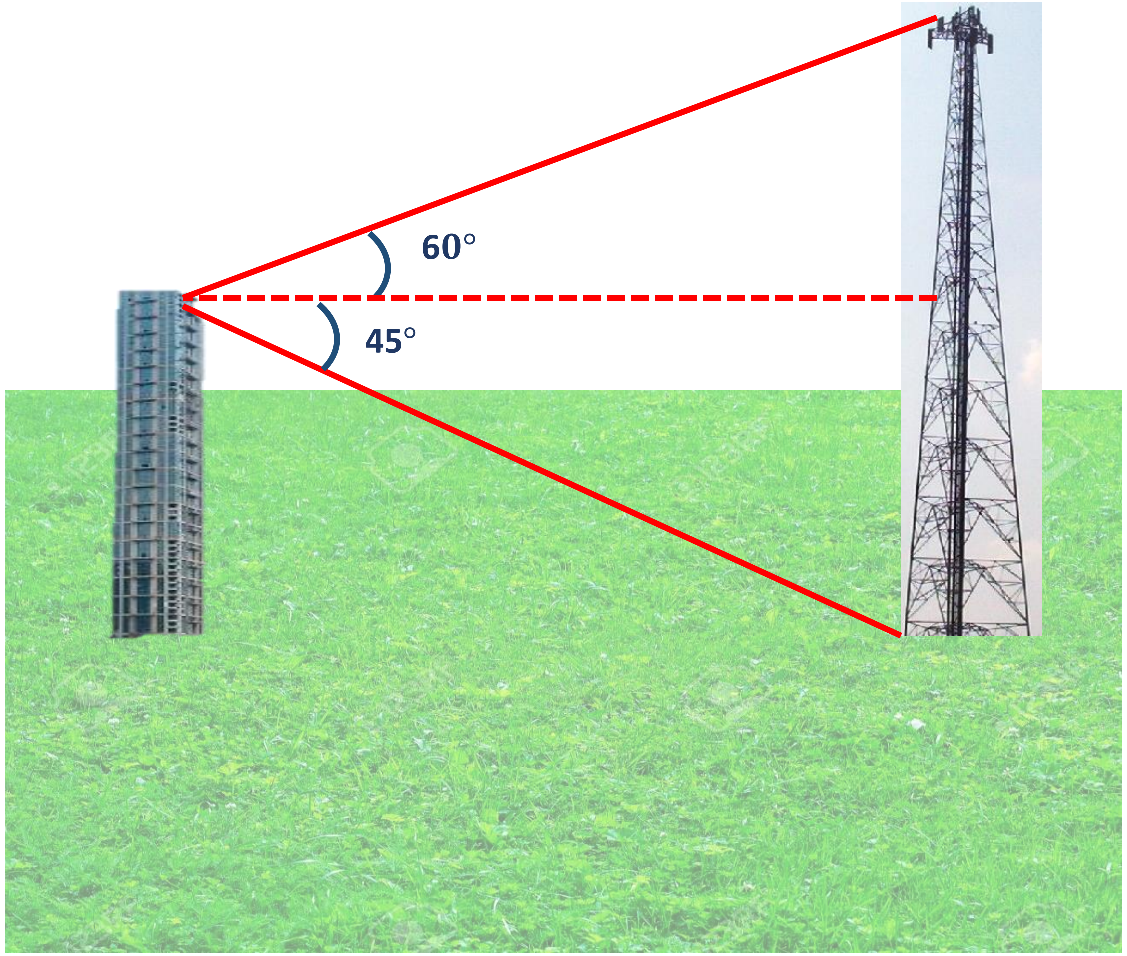
$$= 1.464$$

$\therefore$ *The height of the statue is* $1.464\ m$



4. From the top of a building, the angle of elevation of the top of a cell tower is 60° and the angle of depression to its foot is 45°. If distance of the building from the tower is 7m, then find the height of the tower.

Sol:



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4. From the top of a building, the angle of elevation of the top of a cell tower is 60° and the angle of depression to its foot is 45°. If distance of the building from the tower is 7m, then find the height of the tower.

Sol: Let

AB – Height of the bulding

CD – height of the tower

AE – horizontal line

Given $\angle CAE = 60^\circ$ $\angle DAE = 45^\circ$

$AE = BD = 7\ m$

$AE \parallel BD$ $so\ that$ $\angle ADB = 45^\circ$

From ΔABD, $tanD = \dfrac{AB}{BD}$

$$tan45^\circ = \frac{AB}{7}$$

$$1 = \frac{AB}{7}$$

$$AB = 7$$

$$ED = AB = 7$$

From ΔAEC, $tanA = \dfrac{CE}{AE}$

$$tan60^\circ = \frac{CE}{7}$$

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

$$CE = 7\sqrt{3}$$

Height of the tower is CD $= CE + ED$

$$= 7\sqrt{3} + 7$$

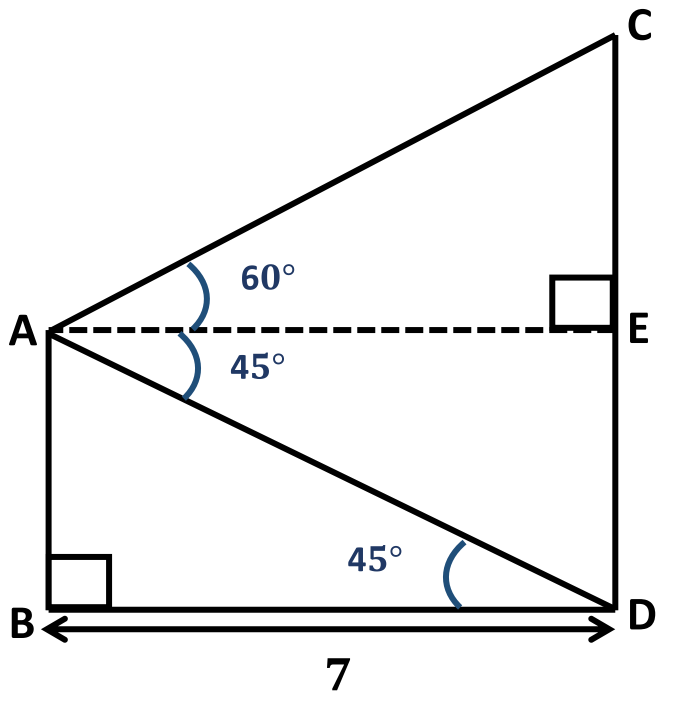
$$= 7(\sqrt{3} + 1)$$

$$= 7(1.732 + 1)$$

$$= 7(2.732)$$

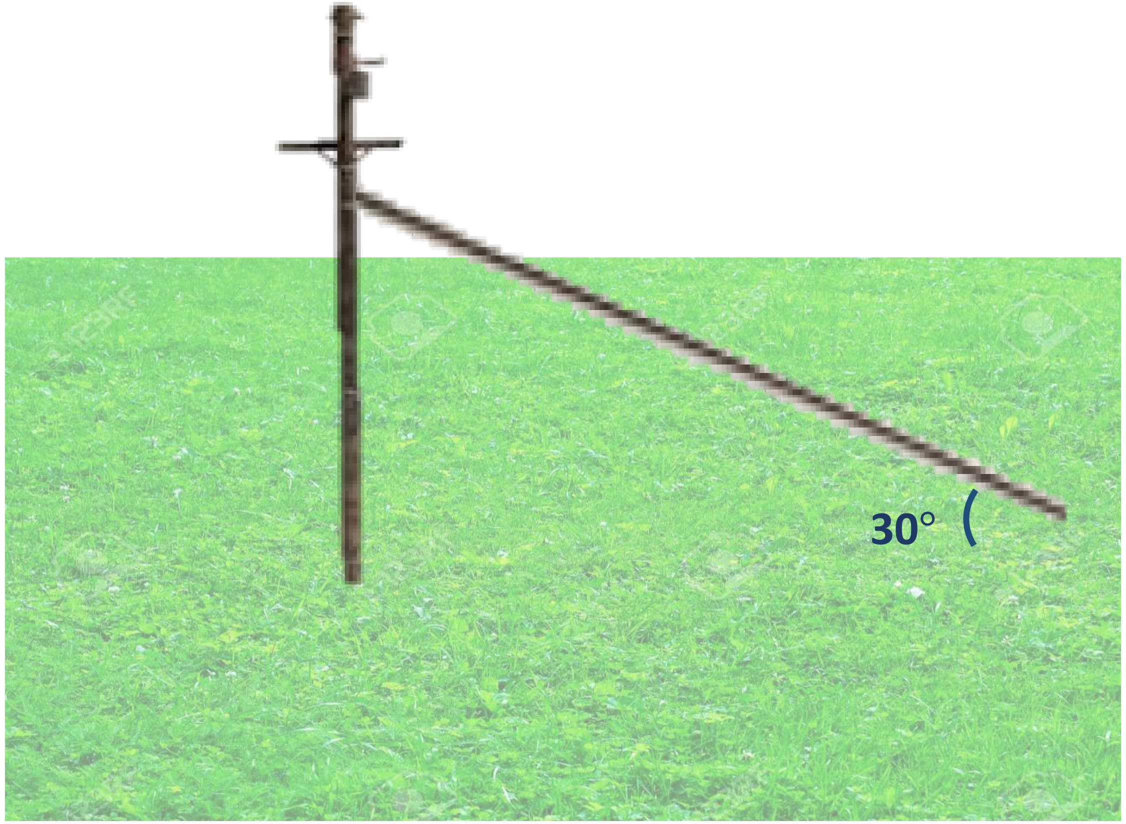
$$= 19.124$$

$\therefore$ *The height of the tower is* $19.124\ m$



5. A wire of length 18 m had been tied with electric pole at an angle of elevation 30° with the ground. Because it was covering a long distance, it was cut and tied at an angle of elevation 60° with the ground. How much length of the wire was cut?

Sol:



5. A wire of length 18 m had been tied with electric pole at an angle of elevation 30° with the ground. Because it was covering a long distance, it was cut and tied at an angle of elevation 60° with the ground. How much length of the wire was cut?

Sol: Let

AB – height of the pole = 'h' m

C and D are the points where the wire was tied on the ground

CD = 'x' m

Given $\angle ADB = 30°$ $\angle ACB = 60°$ $AD = 18$

From ΔABD, $sinD = \frac{AB}{AD}$

$$sin30° = \frac{h}{18}$$

$$\frac{1}{2} = \frac{h}{18}$$

$$h = \frac{18}{2}$$

$$h = 9\ m$$

From ΔABC, $sinC = \frac{AB}{AC}$

$$sin60° = \frac{h}{AC}$$

$$\frac{\sqrt{3}}{2} = \frac{9}{AC}$$

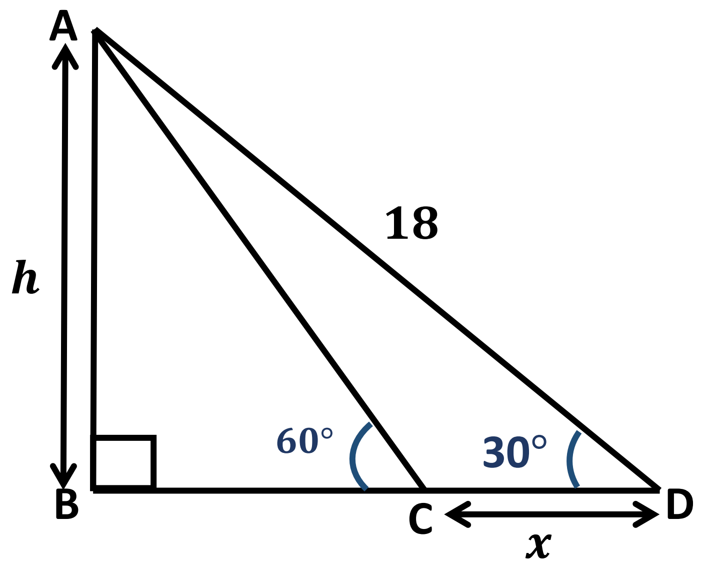
$$AC = \frac{18}{\sqrt{3}}$$

$$AC = \frac{6 \times 3}{\sqrt{3}}$$

$$AC = 6\sqrt{3}$$

$$AC = 6 \times 1.732$$

$$AC = 10.392$$



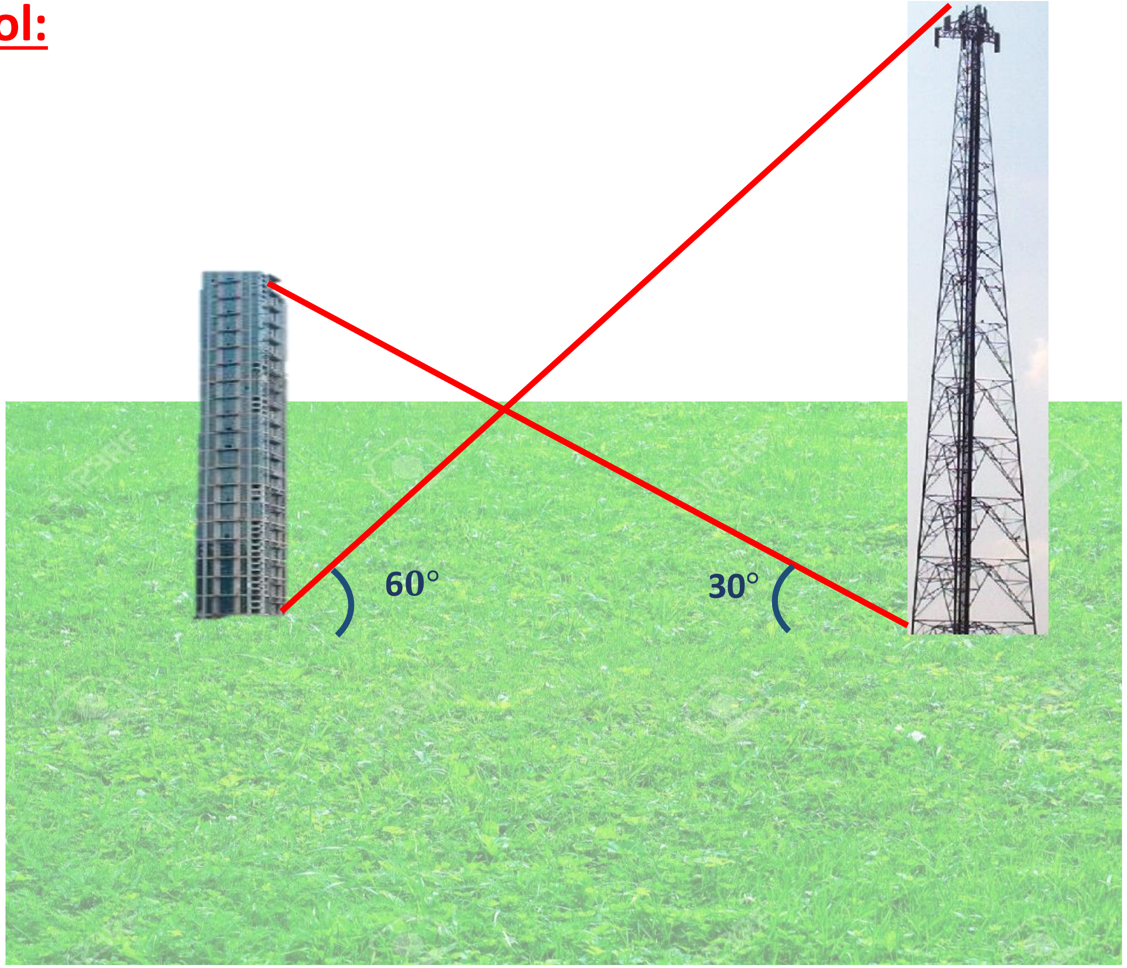
$\therefore$ *The length of the wire was cut* $= AD - AC$

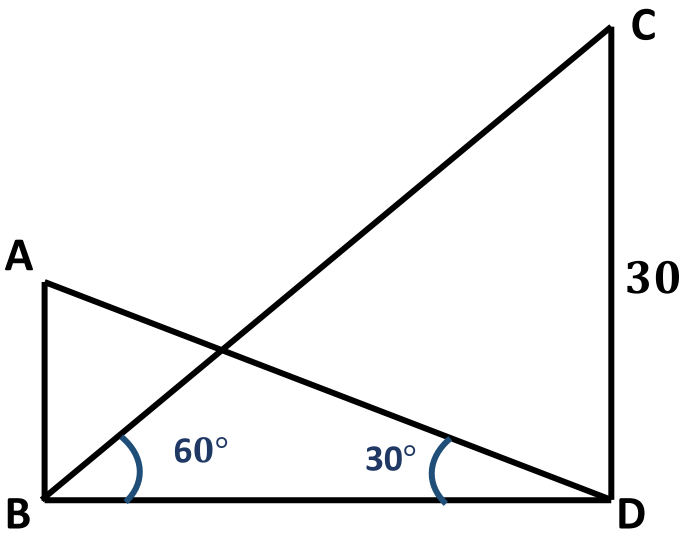
$$= 18 - 10.392$$

$$= 7.608\ m$$

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

Sol:





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

Sol: Let

AB – height of the building

CD – height of the tower = 30 m

Given $\angle ADB = 30°$ $\angle CBD = 60°$ $CD = 30\ m$

From ΔBCD, $tanB = \frac{CD}{BD}$

$$tan60° = \frac{30}{BD}$$

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

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

$$BD = \frac{10 \times 3}{\sqrt{3}}$$

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

From ΔABD, $tanD = \frac{AB}{BD}$

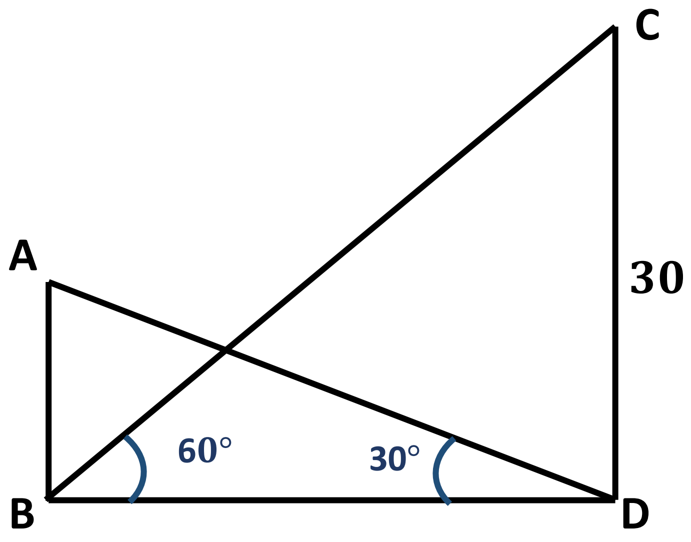
$$tan30° = \frac{AB}{10\sqrt{3}}$$

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

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

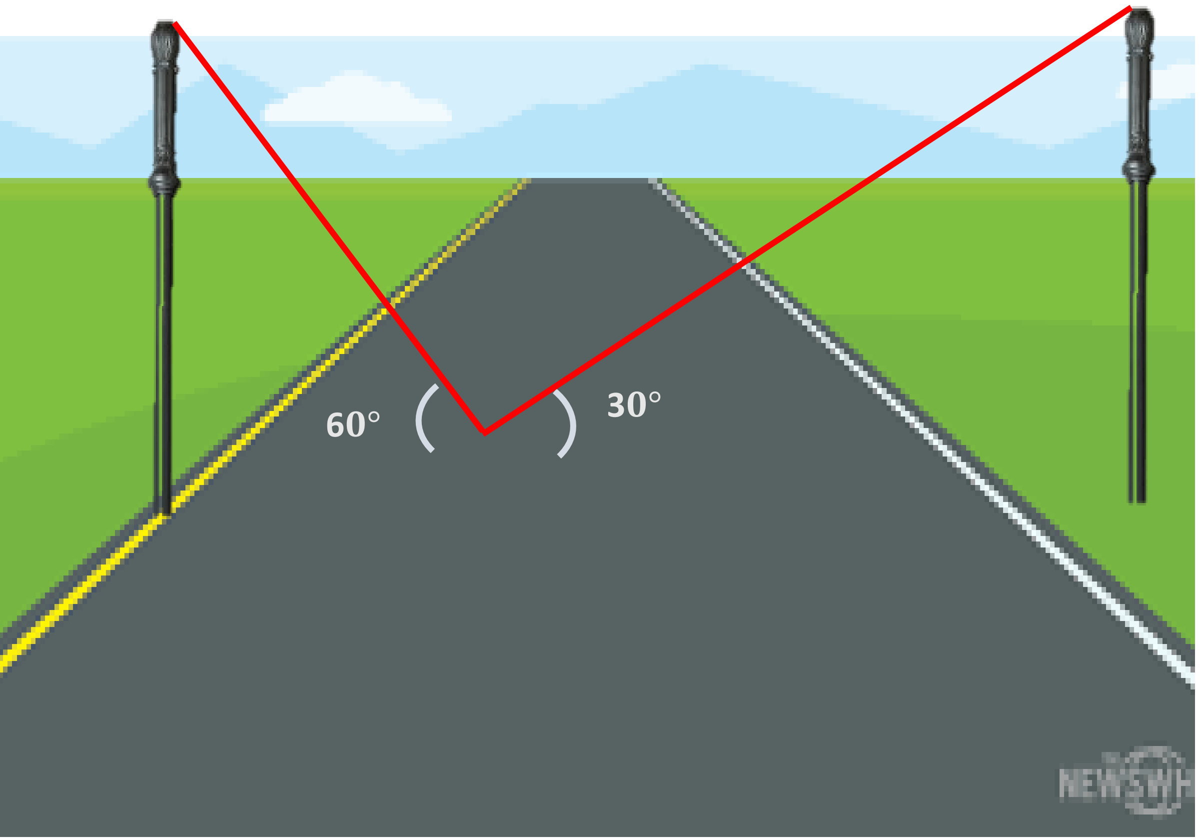
$$AB = 10$$

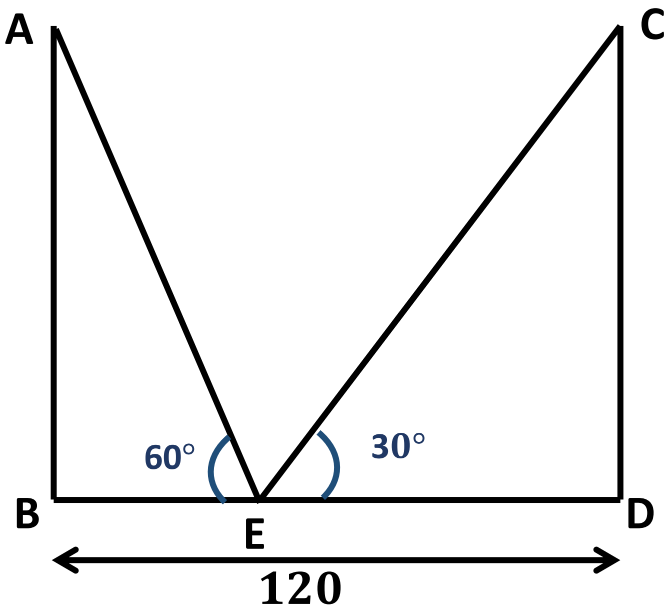
$\therefore$ *The height of the building is* $10\ m$



7. Two poles of equal heights are standing opposite to each other on either side of the road, which is 120 feet 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

Sol:





7. Two poles of equal heights are standing opposite to each other on either side of the road, which is 120 feet 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

Sol: Let AB and CD are poles of equal height.

E – point of observation

BD – width of the road

Given $\angle AEB = 60^\circ$ $\angle CED = 30^\circ$ $BD = 120\ ft$

Let $BE = 'x'\ ft$ then $DE = BD - BE = 120 - x$

From ΔABE, $tanE = \dfrac{AB}{BE}$

$$tan60^\circ = \frac{AB}{x}$$

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

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

From ΔCDE, $tanE = \dfrac{CD}{DE}$

$$tan30^\circ = \frac{CD}{120 - x}$$

$$\frac{1}{\sqrt{3}} = \frac{CD}{120 - x}$$

$$CD = \frac{120 - x}{\sqrt{3}}$$

But, we know AB = CD

$$x\sqrt{3} = \frac{120 - x}{\sqrt{3}}$$

$$120 - x = x\sqrt{3}(\sqrt{3})$$

$$120 - x = 3x$$

$$3x + x = 120$$

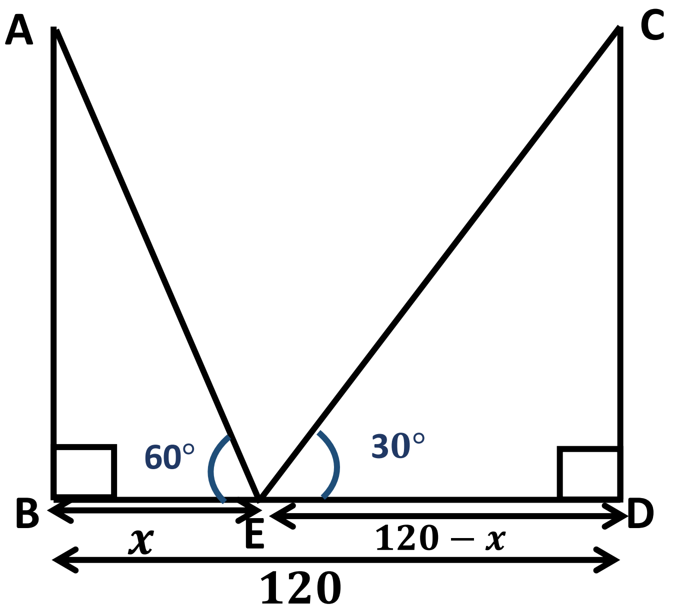
$$4x = 120$$

$$x = \frac{120}{4} = 30$$

$\therefore$ *The height of the pole* $= AB$

$= x\sqrt{3}$

$= 30\sqrt{3}\ ft$



$BE = x = 30$

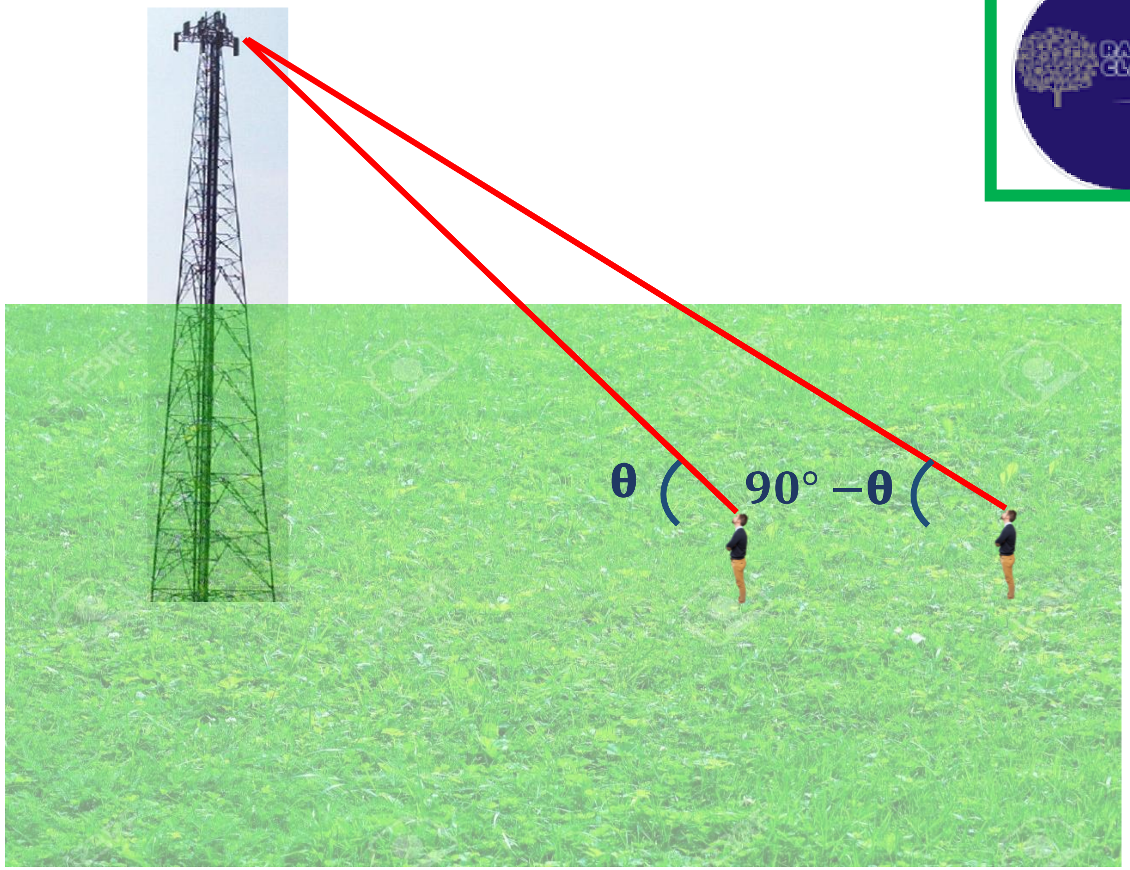
$DE = 120 - x = 120 - 30$

$= 90$

$\therefore$ *The distances of the point from poles are* $30ft.$ *and* $90\ ft.$

8. The angles of elevation of the top of the tower from two points at a distance of 4m and 9m are in a straight line with the tower are complimentary. Find the height of the tower.

Sol:



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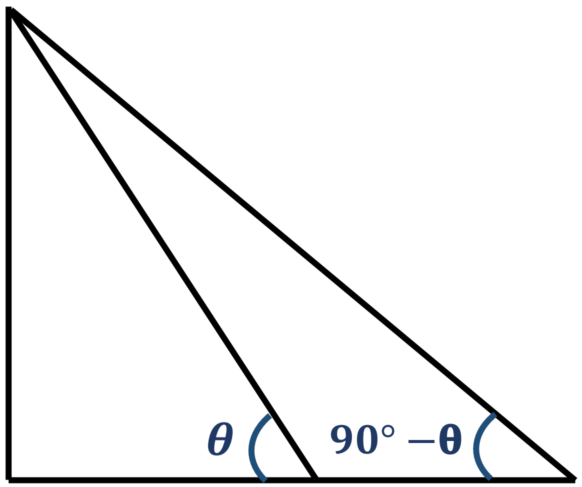


8. The angles of elevation of the top of the tower from two points at a distance of 4m and 9m are in a straight line with the tower are complimentary. Find the height of the tower.

Sol: Let

AB – height of the tower

C and D are points of observation

Given $BC = 4\,m$ $BD = 9\,m$

Let $\angle ACB = \theta$ then $\angle ADB = 90^\circ - \theta$

From ΔABC, $\tan C = \dfrac{AB}{BC}$

$$\tan\theta = \frac{AB}{4} \longrightarrow (1)$$

From ΔABD, $\tan D = \dfrac{AB}{BD}$

$$\tan(90^\circ - \theta) = \frac{AB}{9}$$

$$\cot\theta = \frac{AB}{9} \longrightarrow (2)$$

Multiplying eq.(1) and (2)

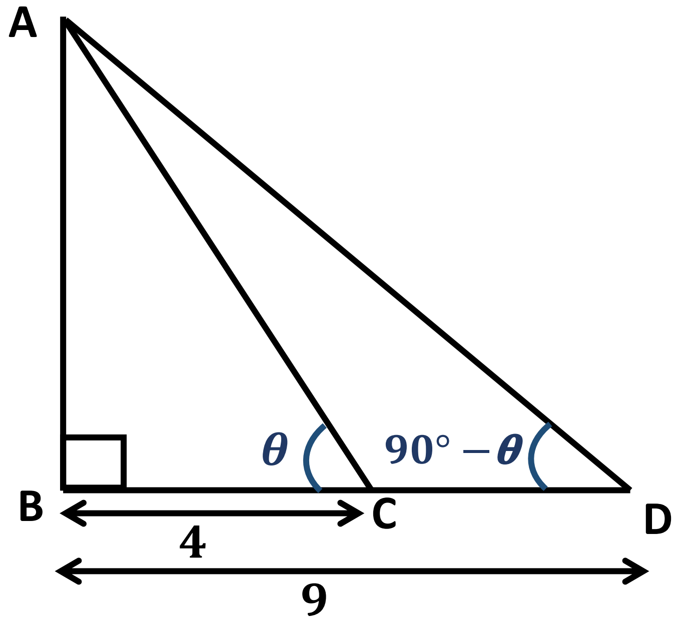
$$\tan\theta.\cot\theta = \frac{AB}{4}.\frac{AB}{9}$$

$$1 = \frac{AB^2}{36}$$

$$AB^2 = 36$$

$$AB = \sqrt{36}$$

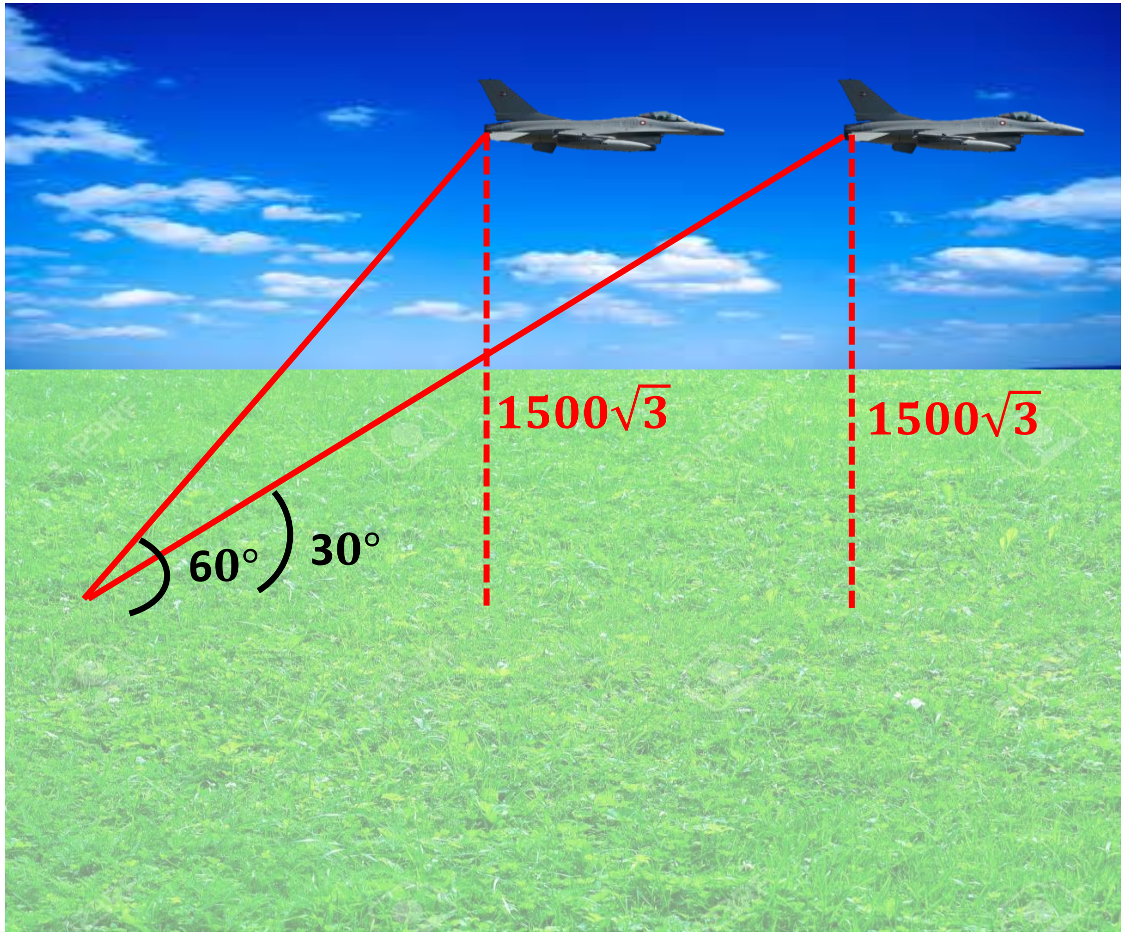
$$AB = 6$$

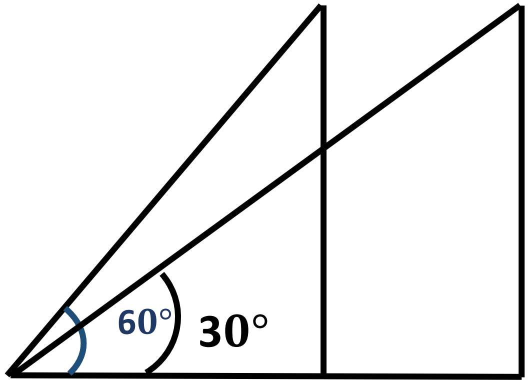


$\therefore$ *The height of the tower is 6 m*

9. The angle of elevation of a jet plane from a point A on the ground is 60°. After a flight of 15 seconds, the angle of elevation changes to 30°. If the jet plane is flying at a constant height of $1500\sqrt{3}$ meter, find the speed of the jet plane. ($\sqrt{3}$ = 1.732)

Sol:





9. The angle of elevation of a jet plane from a point A on the ground is 60°. After a flight of 15 seconds, the angle of elevation changes to 30°. If the jet plane is flying at a constant height of $1500\sqrt{3}$ meter, find the speed of the jet plane. ($\sqrt{3}$ = 1.732)

Sol: Let

A – point of observation

B and D are positions of the plane

BC and DE are vertical lines

Given $BC = DE = 1500\sqrt{3}\,m$

$\angle BAC = 60°$ $\quad\quad \angle DAE = 30°$

From ΔABC, $tanA = \dfrac{BC}{AC}$

$$tan60° = \frac{1500\sqrt{3}}{AC}$$

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

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

$$AC = 1500\,m$$

From ΔADE, $tanA = \dfrac{DE}{AE}$

$$tan30° = \frac{1500\sqrt{3}}{AC}$$

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

$$AE = 1500\sqrt{3}(\sqrt{3})$$

$$AE = 1500 \times 3$$

$$AE = 4500\,m$$

Now

$$BD = CE = AE - AC$$

$$= 4500 - 1500$$

$$= 3000 \text{ m}$$

The distance travelled by the plane in 15 seconds is 3000 m

The speed of the plane = $\dfrac{distance}{time}$

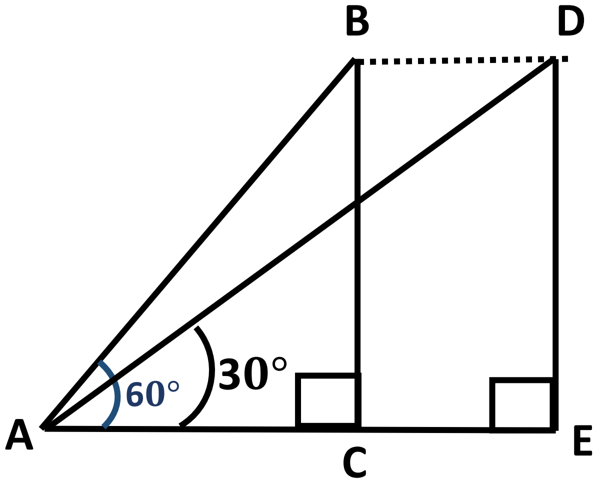
$$= \frac{3000\,m}{15\,sec}$$

$$= 200\,m/sec$$

$$= \frac{200\times 18}{5}\,km/hr$$

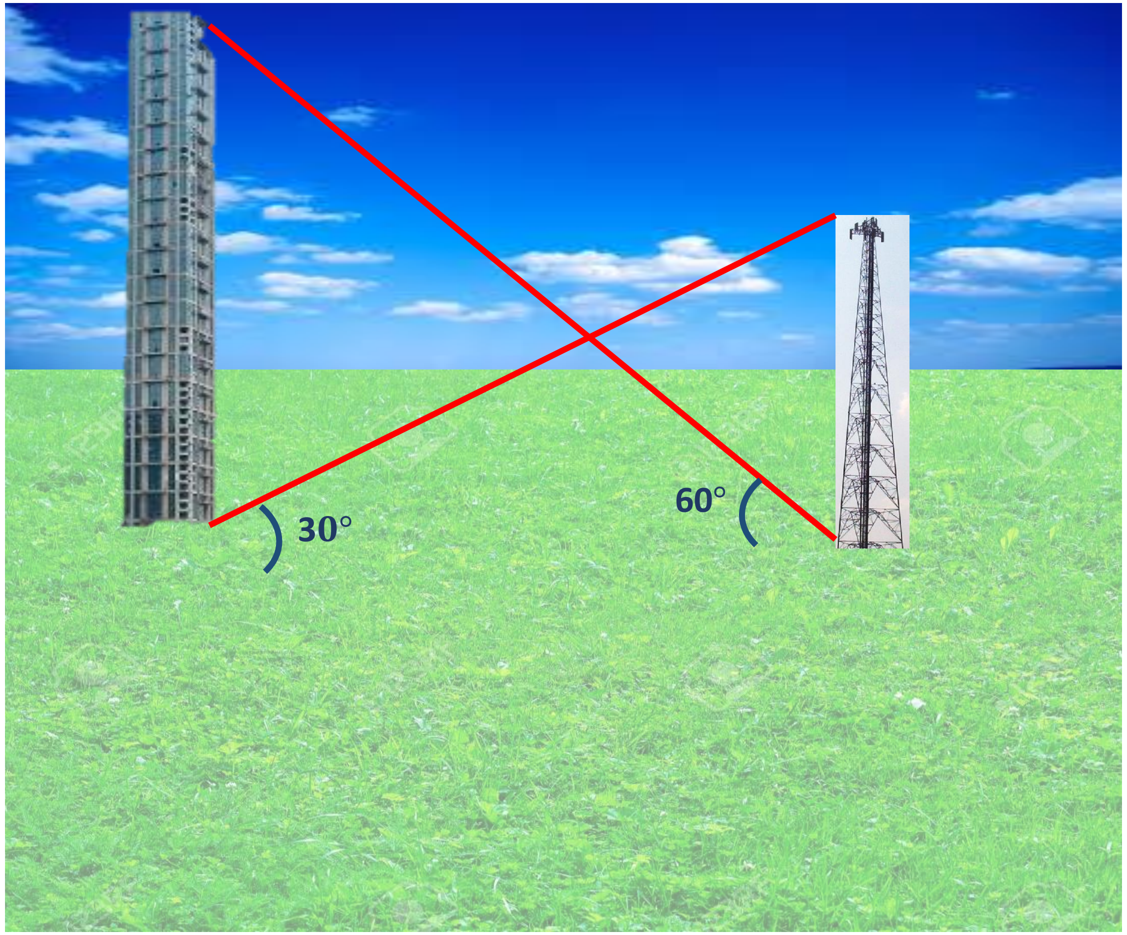
$$= 720\,km/hr$$

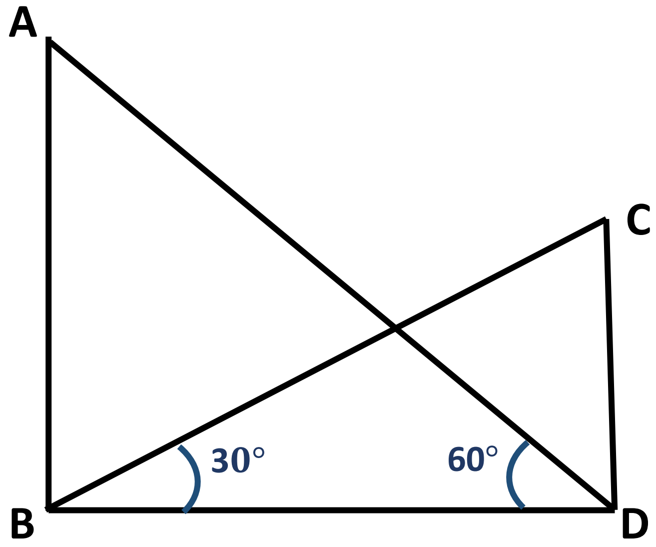
$\therefore$*The speed of the plane is 720 km/hr*



10. The angle of elevation of the top of a tower from the foot of the building is 30° and the angle of elevation of the top of the building from the foot of the tower is 60°. What is the ratio of heights of tower and building.

Sol:





10. The angle of elevation of the top of a tower from the foot of the building is 30° and the angle of elevation of the top of the building from the foot of the tower is 60°. What is the ratio of heights of tower and building.

Sol: Let

AB – height of the building

CD – height of the tower

Given $\angle ADB = 60°$ $\angle CBD = 30°$

From ΔBCD, $tanB = \dfrac{CD}{BD}$

$$tan30° = \frac{CD}{BD}$$

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

$$BD = CD\sqrt{3} \longrightarrow (1)$$

From ΔABD, $tanD = \dfrac{AB}{BD}$

$$tan60° = \frac{AB}{BD}$$

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

$$BD = \frac{AB}{\sqrt{3}} \longrightarrow (2)$$

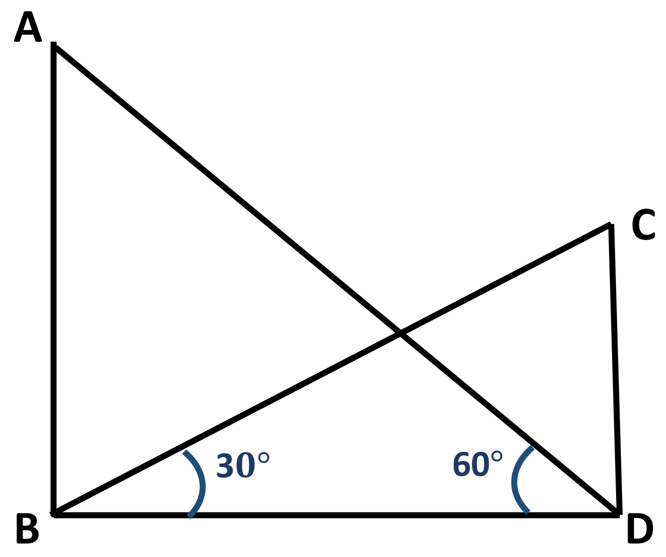
From $eq\ (1) and\ (2)$,

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

$$\sqrt{3}(\sqrt{3}) = \frac{AB}{CD}$$

$$\frac{AB}{CD} = 3$$

$$\frac{CD}{AB} = \frac{1}{3}$$



$\therefore The\ ration\ of\ the\ heights\ of\ tower\ and\ building\ is\ 1:3$

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