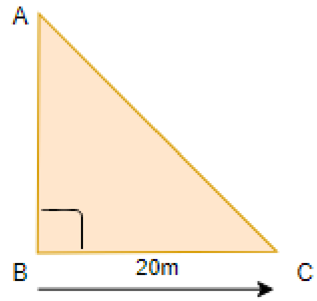
APPLICATION OF TRIGONOMETRY

CLASS X (2025-26) SUJITHKUMAR KP 15-8-25

1 The angle of elevation of the top of a tower from a point 20 metres away from the base is 45°. Find the height of the tower.

Let AB is the tower and C is the point 20 m away from the base of the tower



BC = 20 m, $\angle$ ACB = 45°

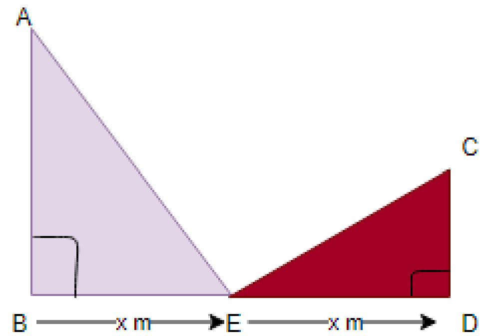
In right Δ ABC, tan 45° = $\frac{AB}{BC}$

$1 = \frac{AB}{20}$ AB = 20 m

Height of the tower = 20 m.

2 If two towers of height h_1 and h_2 subtends angles of 60° and 30° respectively at the mid points of line joining their feet, find $h_1 : h_2$.

Let AB and CD are towers of height h_1 and h_2 respectively



If E is the midpoint of BD then BE = DE = x

In right Δ ABE

$\frac{h_1}{x}$ = tan 60°

$\Rightarrow h_1 = \sqrt{3}x$ ...(i)

In right Δ CDE $\frac{h_2}{x} = tan 30°$

$\Rightarrow h_2 = \frac{x}{\sqrt{3}}$ ......(ii)

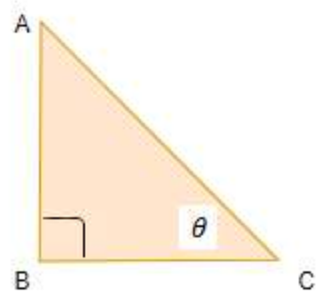
$\frac{h1}{h_2} = \frac{\sqrt{3}x}{\frac{x}{\sqrt{3}}} = \frac{3}{1}$

Now $\Rightarrow h_1 : h_2 = 3 : 1$

3 Find the angle of elevation of the top of 15 m high tower at a point 15 m away from the base of the tower.

Let AB is the tower, AB = 15 m, BC = 15 m Let

$\angle C = \theta$



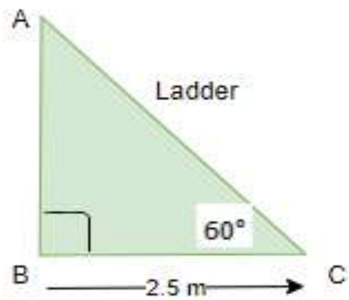
In right Δ ABC, $tan\theta = \frac{AB}{BC}$

$$\Rightarrow tan\theta = \frac{15}{15} = 1 \Rightarrow \theta = 45°$$

4 A ladder, leaning against a wall, makes an angle of 60° with the horizontal. If the foot of the ladder is 2.5 m away from the wall, find the length of the ladder.

In right Δ ABC , $\frac{BC}{AC}$ = cos 60°

$$\frac{2.5}{AC} = \frac{1}{2} \Rightarrow AC = 2.5 \times 2 = 5cm$$



5 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 angle of depression of the base of the hill as 30°. Find the distance of the hill from the ship and height of the hill.

Let CD is deck of ship and AB is hill. CD = BE = 10 m

In Δ BEC, $\frac{CE}{BE} = cot30°$ $\Rightarrow CE = BE.cot30°$

$\Rightarrow CE = 10\sqrt{3} = 17.3m$

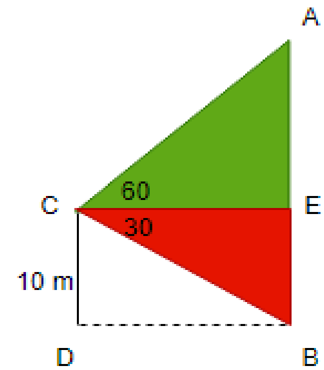
In Δ AEC, $\frac{AE}{CE} = tan60°$

$AE = CE.\sqrt{3} \times \sqrt{3}\ m$

$= 30\ m$

Height of hill AB = AE + EB = (30 + 10) m = 40 m

Distance of hill CE = 17.3 m



6 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 metres towards the foot of the tower to a point B, the angle of elevation increases to 60°. Find the height of the tower and distance of the tower from the point A. ($\sqrt{3}$ = 1.732)

Let 'h' m be height of the tower PQ.

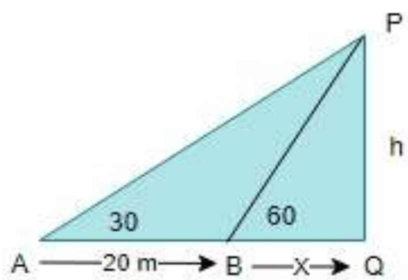
AB = 20 m. Let BQ = x m

In rt. ΔPQB,

$\frac{PQ}{BQ} = tan60° \Rightarrow \frac{h}{x} = \sqrt{3} \Rightarrow h = \sqrt{3}\,x$ ...(i)

In rt. ΔPQA,

$\frac{PQ}{AQ} = tan30° \Rightarrow \frac{h}{20+x} = \frac{1}{\sqrt{3}} \Rightarrow \sqrt{3}h = 20 + x$ ...(ii)



From (i) and (ii)

$\Rightarrow \sqrt{3}.\sqrt{3}x = 20 + x$

$\Rightarrow x = 10$

Distance of tower from A is 20 m + 10 m = 30 m

Put x = 10 in (i), we get

$h = \sqrt{3} \times 10 = 1.732 \times 10 = 17.32$ m

Height of tower is 17.32 m.

7 A statue 1.46 m tall stands on the top of a 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 pedestal. ($\sqrt{3}$ = 1.73)

Let AB is statue, BC is pedestal and BC = x m, CD = y m.

In right ΔBCD, $\frac{BC}{CD} = tan45°$

$\Rightarrow \frac{x}{y} = 1 \Rightarrow x = y$ ...(i)

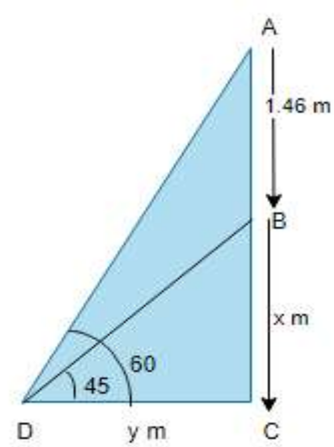
In right ΔACD , $\frac{AC}{CD}$ = tan 60°

$\Rightarrow \frac{(x+1.46)}{y} = \sqrt{3}$

$\Rightarrow \frac{(x+1.46)}{x} = 1.73$ [Using (i)]

$\Rightarrow x + 1.46 = 1.73x \Rightarrow 0.73x = 1.46 \Rightarrow x = 2$

Height of pedestal = 2 m.



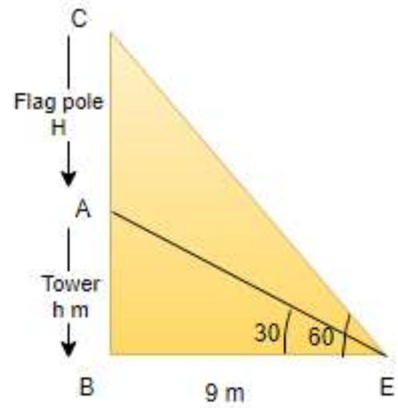
8 On a horizontal plane there is a vertical tower with a flag pole on the top of the tower. At a point 9 metres away from the foot of the tower the angles of elevation of the top and bottom of the flag pole are 60° and 30° respectively. Find the heights of the tower and flag pole mounted on it. ($\sqrt{3}$ = 1.732)

Given: AB be the tower and AC the flag pole on top of the tower.

CEB = 60°, AEB = 30°

To find: Height of the tower and the height of the flag pole.

Let height of the tower and flag pole be h m and H m respectively.



Solution: In right ΔABE

$\frac{AB}{BE} = tan30° \Rightarrow \frac{h}{9} = \frac{1}{\sqrt{3}}$

$\Rightarrow h = \frac{9}{\sqrt{3}} = 3\sqrt{3} = 5.196$ ...(i)

In right ΔCBE,

$\frac{CB}{BE} = tan60° \Rightarrow \frac{(h+H)}{BE} = tan60°$

$\frac{(h+H)}{BE} = \sqrt{3}$

$h + H = 9\sqrt{3}$ ...(ii)

From (i) and (ii)

$\frac{9}{\sqrt{3}} + H = 9\sqrt{3} \Rightarrow H = 9\sqrt{3} - \frac{9}{\sqrt{3}}$

$H = \frac{27-9}{\sqrt{3}} = 6\sqrt{3}\, m$

= 6 × 1.732 m = 10.392 m

Height of flag pole mounted on tower = 10.392 m

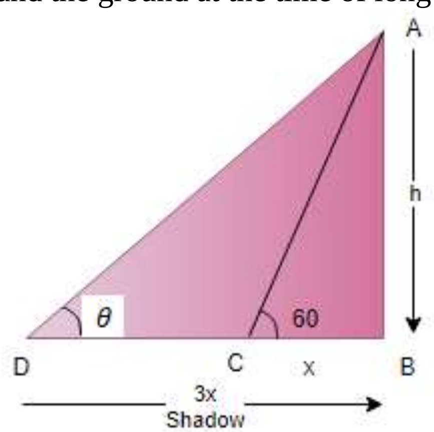
9 The shadow of a flagstaff is three times as long as the shadow of the flagstaff when the sunrays meet the ground at an angle of 60°. Find the angle between the sunrays and the ground at the time of longer shadow

In rt. ΔABC, tan 60° = $\frac{AB}{BC} = \frac{h}{c}$

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

In rt. ΔABD, $tan\, \theta = \frac{AB}{BD} \Rightarrow \frac{h}{3x} = tan\, \theta$

$$tan\, \theta = \frac{\sqrt{3}x}{3x} = \frac{1}{\sqrt{3}} \Rightarrow \theta = 30°$$

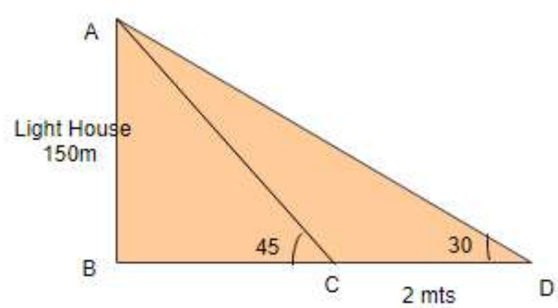


10 A man rowing a boat away from a lighthouse 150 m high takes 2 minutes to change the angle of elevation of the top of lighthouse from 45° to 30°. Find the speed of the boat. (Use $\sqrt{3}$ = 1.732)

Let AB is lighthouse.

AB = 150 m

Initially boat is at C and after 2 minutes it reaches at D.



In right Δ ABC,

$\frac{AB}{BC} = tan45°$

$\Rightarrow \frac{150}{BC} = 1 \Rightarrow BC = 150m$

In right Δ ABD , $\frac{AB}{BD}$ = tan 30°

$\Rightarrow \frac{150}{BD} = \frac{1}{\sqrt{3}} \Rightarrow BD = 150\sqrt{3}$ m

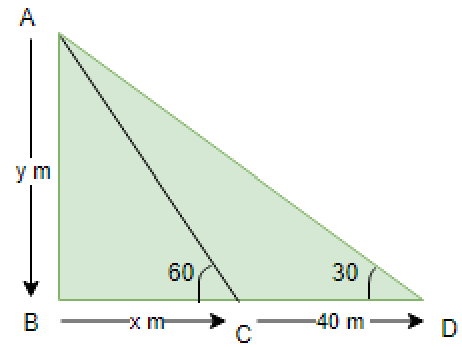
Distance covered in 2 minutes = BD – BC = $150\sqrt{3}$ – 150 = 150 ($\sqrt{3}$ – 1) m

$speed = \frac{D}{T} = \frac{150(\sqrt{3})-1}{2}$

$= 75 \times (1.732 - 1) = 54.9$ m/minutes

11 A person standing on the bank of a river observes that the angle of the elevation of the top of a tree standing on the opposite bank is 60°. When he moves 40 m away from the bank, he finds the angle of elevation to be 30°. Find the height of the tree and the width of the river. ($\sqrt{3}$ = 1.732)

Let AB is tree and BC is width of river.



Also, let AB = y m and BC = x m

∠ BCA = 60° and ∠ BDA = 30°

In right ΔABC,

$\frac{AB}{BC} = tan60°$

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

$\Rightarrow y = \sqrt{3}\,x$ ...(i)

In right ΔABD, $\frac{AB}{BD}$ = tan 30°

$\Rightarrow \frac{y}{x+40} = \frac{1}{\sqrt{3}}$

$\Rightarrow \sqrt{3}\, y = x + 40$

$\Rightarrow \sqrt{3}\,(\sqrt{3}\,x) = x + 40$ [Using (i)]

$\Rightarrow 2x = 40 \Rightarrow x = 20$ m

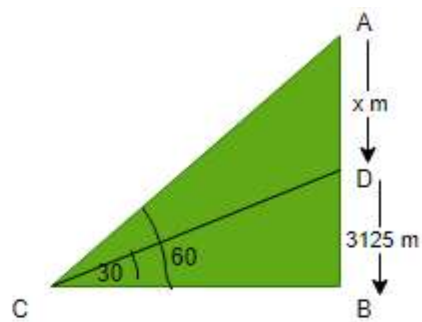
$y = \sqrt{3} \times 20 = 1.732 \times 20$

= 34.64 m

Height of tree = 34.64 m and width of river = 20 m

12 An aeroplane when flying at a height of 3125 m from the ground passes vertically below another plane at an instant when the angles of elevation of the two planes from the same point on the ground are 30° and 60° respectively. Find the distance between the two planes at that instant.

Let A and D are two aero planes such that BD = 3125 m.



∠ ACB = 60°, ∠ DCB = 30°

In rt. ΔABC, $\frac{AB}{BC}$ = tan 60°

$\Rightarrow \frac{x+3125}{BC} = \sqrt{3}$

$\Rightarrow$ BC = $\frac{3125+x}{\sqrt{3}}$

In rt. ΔDBC, $\frac{DB}{BC} =$ tan 30°

$\Rightarrow \frac{BD}{BC} = \frac{1}{\sqrt{3}}$

$BD = \frac{BC}{\sqrt{3}} = \frac{3125+x}{\sqrt{3}} \times \frac{1}{\sqrt{3}}$

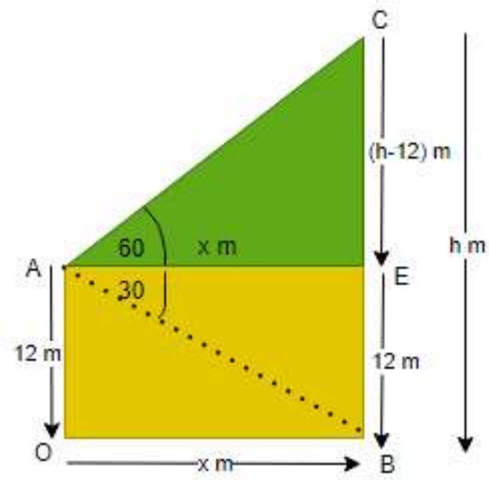
$3125 = \frac{3125+x}{3}$ m

Now, x = 6250 m

AD = 6250 m

13 A man on the deck of a ship, 12 m above water level, observes that the angle of elevation of the top of a cliff is 60° and the angle of depression of the base of the cliff is 30°. Find the distance of the cliff from the ship and the height of the cliff. [Use $\sqrt{3}$ = 1.732]

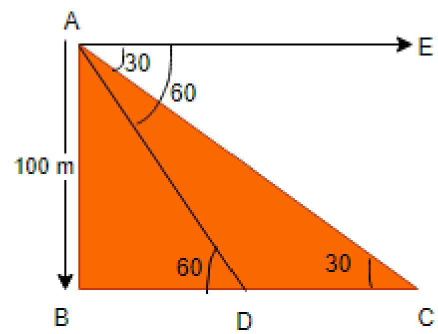
A is the position of the man, OA = 12m, BC is cliff.
Let height of the cliff
BC = h m and CE = (h – 12) m.
Let AE = OB = x m
In right angled triangle AEB,
$\frac{AE}{BE} = cot30°$
⇒ AE = 12 × $\sqrt{3}$
= 12 × 1.732 m = 20.78 m.
Distance of ship from cliff = 20.78 m.
In right angled triangle AEC,
$\frac{CE}{AE} = tan60°$ ⇒ $\frac{h-12}{12\sqrt{3}} = \sqrt{3}$
h – 12 = 36
⇒ h = 48 m
Height of the cliff = 48 m.



14 As observed from the top of a light-house, 100 m high above sea level, the angle of depression of a ship, sailing directly towards it, changes from 30° to 60°. Determine the distance travelled by the ship during the period of observation. (Use $\sqrt{3}$= 1.732)

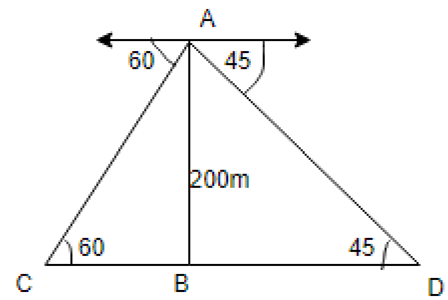
Given: AB the lighthouse 100 m above sea level and C is a ship sailing towards AB.
⇒ EAC = 30°
After travelling from C to C′ angle of depression changes from EAC = 30° to EAD = 60°
To Find: CC′
Solution: AE ∥ BC [Line of sight and line of horizontal]
⇒ ACD = EAC = 30° [Alternate angles]
ADB = EAD = 60° [Alternate angles]
In right ΔABC, $\frac{AB}{BC}$ = tan 30°
$\frac{100}{BC} = \frac{1}{\sqrt{3}} \Rightarrow BC = 100\sqrt{3}$
In right ΔABD, $\frac{AB}{BD} = tan60°$
$\Rightarrow \frac{100}{BD} = \sqrt{3}$
$\Rightarrow BD = \frac{100}{\sqrt{3}}$
CD = BC – BD

$$= 100\sqrt{3} - \frac{100}{\sqrt{3}} = \frac{200}{\sqrt{3}} = \frac{200\sqrt{3}}{3} = 115.466m$$



15 Two ships are there in the sea on either side of a light house in such a way that the ships and the light house are in the same straight line. The angles of depression of two ships as observed from the top of the light house are 60° and 45°. If the height of the light house is 200 m, find the distance between the two ships. [Use $\sqrt{3}$ = 1.73]

ANS: Let AB be the light house of height 200 m. C and D are two ships on either sides of light house with angles of depression 60° and 45° respectively
ACB = 60° and ADB = 45°. [Alternate angles in both cases]
In right-angled triangle ABC,
$\frac{BC}{AB} = cot60°$



$\Rightarrow \ BC = 200 \times \frac{1}{\sqrt{3}} = \frac{200}{\sqrt{3}} \ m$ ...(i)

In right-angled triangle ABD,

$\frac{BD}{AB}$ = cot 45°

⇒ BD = 200 × 1 = 200 m ...(ii)

Distance between ships = CD = CB + BD

$\frac{200}{\sqrt{3}} + 200 = 200 \times \frac{1.73}{3} + 200$

$= \frac{346}{3} + 200 = 115.33 + 200 =$ 315.33m

16 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 45°. If the tower is 30 m high, find the height of the building.

et height of the building = h

In Δ ABC, $\frac{AB}{AC}$ = tan 45°

$\frac{30}{AC} = 1$

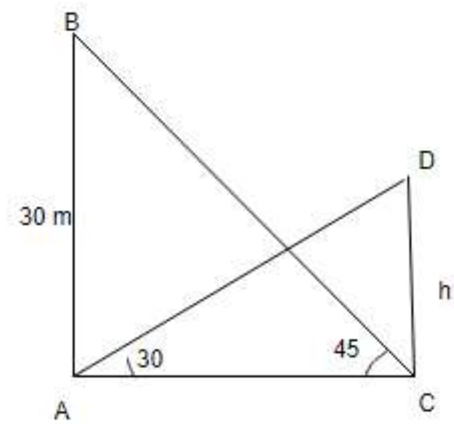
⇒ AC = 30 m

In Δ ACD,

$\frac{CD}{AC} = tan30°$

$\frac{h}{30} = \frac{1}{\sqrt{3}}$

$h = \frac{30}{\sqrt{3}} = 10\sqrt{3}\, m$



17 The angle of elevation of the top of a vertical tower from a point on the ground is 60°. From another point 10 m vertically above the first, its angle of elevation is 30°. Find the height of the tower.

Let AB is tower and BC = x m

BE = CD ⇒ BE = 10 m

Also BC = DE = x m. Take AE = y m.

In right Δ AED, $\frac{AE}{DE}$ = tan 30°

$\Rightarrow \frac{y}{x} = \frac{1}{\sqrt{3}} \ \Rightarrow \ x = \sqrt{3}y$ ...(i)

In right Δ ABC, $\frac{AB}{BC}$ = tan 60°

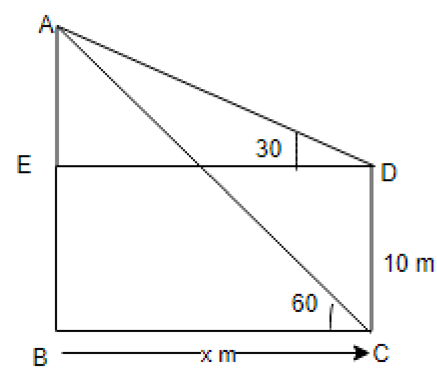
$\Rightarrow \ \frac{y+10}{x} = \sqrt{3} \ \Rightarrow \ y + 10 = \sqrt{3}\,x$

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

⇒ y + 10 = 3y

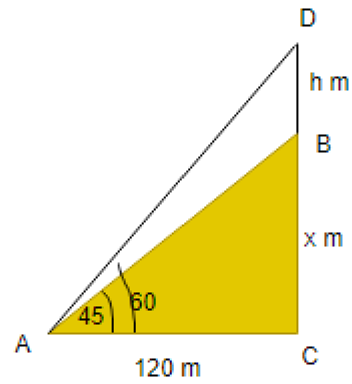
⇒ y = 5m

Height of tower = AE + BE = 5 + 10 = 15m



18 The angle of elevation of the top of a tower at a distance of 120 m from a point A on the ground is 45°. If the angle of elevation of the top of a flagstaff fixed at the top of the tower, from A is 60°, then find the height of the flagstaff. [Use $\sqrt{3}$ = 1.73]

Let BC be the tower and BD is flagstaff of height h m.
Let BC = x m.
AC = 120 m, BAC = 45° and DAC = 60°
In right-angled triangle ACB,



$\frac{AC}{BC} = cot45° \Rightarrow \frac{120}{x} = x$

$x = 120$ ...(i)

In right angled triangle ACD,

$\frac{CD}{AC} = tan60° \Rightarrow \frac{h+x}{120} = \sqrt{3}$

$\Rightarrow h + x = 120\sqrt{3}$

$\Rightarrow h = 120\sqrt{3} - 120$ [using (i), x = 120]

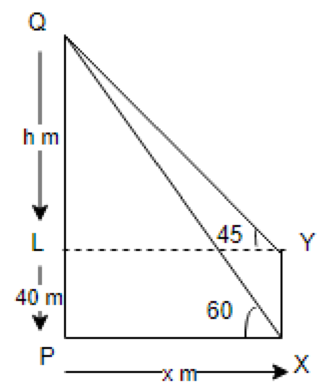
$\Rightarrow h = 120[\sqrt{3} - 1] = 120[1.73 – 1]$

m = 120 × 0.73 = 87.6 m

Height of the flagstaff is 87.6 m.

19 The angle of elevation of the top Q of a vertical tower PQ from a point X on the ground is 60°. At a point Y, 40 m vertically above X, the angle of elevation is 45°. Find the height of the tower PQ.

Draw YL parallel to XP intersecting PQ at L.



⇒ PXYL is a rectangle.
⇒ PL = XY = 40 m, LY = PX = x m opposite sides of a rectangle.
Let QL be h m and PX be x m

In ΔQLY, $\frac{QL}{LY} = tan45°$

$\Rightarrow \frac{h}{x} = \tan 45° \quad \Rightarrow h = x$ m ...(i)

In ΔQPX , $\frac{QP}{PX} = \tan 60°$

$\Rightarrow \frac{h+40}{x} = \sqrt{3} \quad \Rightarrow h + 40 = \sqrt{3}\, x$

Using (i), $h + 40 = \sqrt{3}\, h$

$40 = \sqrt{3}\, h - h \Rightarrow 40 = (\sqrt{3} - 1)h$

$$h = \frac{40}{\sqrt{3} - 1} = \frac{40}{\sqrt{3} - 1} \times \frac{\sqrt{3} + 1}{\sqrt{3} + 1}$$

$= \frac{40 \times 2.732}{3-1} = 54.64$

Height of the tower PQ = h + 40 = 40 + 54.64 = 94.64 m

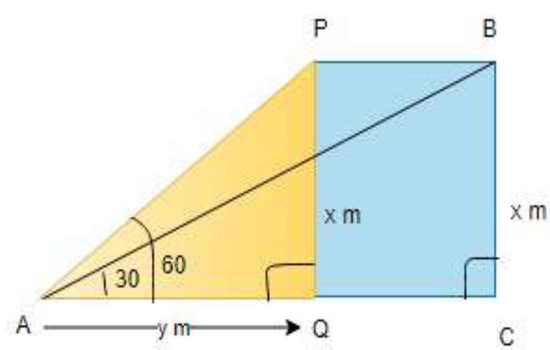
20 The angle of elevation of a jet fighter from a point A on the ground is 60°. After a flight of 15 seconds, the angle of elevation changes to 30°. If the jet is flying at a speed of 720 km/hr, find the constant height. ($\sqrt{3}$ = 1.732).

Speed of jet fighter = 720 km/h = 200 m/s

Distance covered in 15 seconds = 200 × 15 = 3000 m

PB = 3000 m

PB = QC = 3000 m



In right ΔPQA, $\frac{PQ}{AQ} = \tan 60°$

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

$\Rightarrow x = \sqrt{3}\, y$ ...(i)

In right ΔBCA, $\frac{BC}{AC} = \tan 30° \Rightarrow \frac{x}{y+3000} = \frac{1}{\sqrt{3}}$

$x = \frac{y+3000}{\sqrt{3}}$ ...(ii)

$\sqrt{3}$ y = $\frac{y+3000}{\sqrt{3}}$

From (i) and (ii),

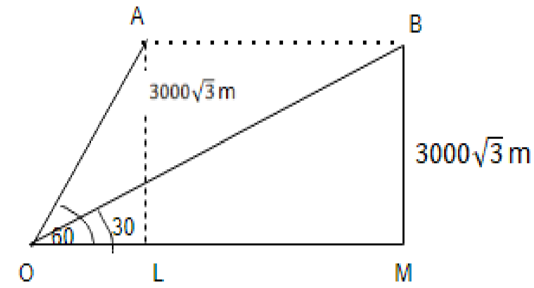
3y = y + 3000 ⇒ 2y = 3000 ⇒ y = 1500 m

x = 1500 × $\sqrt{3}$ m

x = 1500$\sqrt{3}$ = 1500 × 1.732 m = 2598 m

21 The angle of elevation of an aero plane from a point on the ground is 60°. After a flight of 30 seconds the angle of elevation becomes 30°. If the aero plane is flying at a constant height of 3000 $\sqrt{3}$ m, find the speed of the aero plane.

From the point of observation (O), plane is at A, AL = 3000$\sqrt{3}$ m and AOL = 60°.



After 30 seconds, plane is at B, therefore,

BM = 3000$\sqrt{3}$ m and BOM = 30°.

Distance AB is covered in 30 seconds.

In right-angled triangle OLA,

$\frac{OL}{AL} =$ cot 60°

OL = 3000$\sqrt{3}$ × $\frac{1}{\sqrt{3}}$ = 3000 m ...(i)

In right-angled triangle OMB,

$\frac{OM}{BM} =$ cot 30°

$\Rightarrow\ OM = 3000\sqrt{3} \times \sqrt{3}$ = 9000 m ...(ii)

AB = LM = OM – OL = (9000 – 3000) m = 6000 m [from (i) and (ii)]

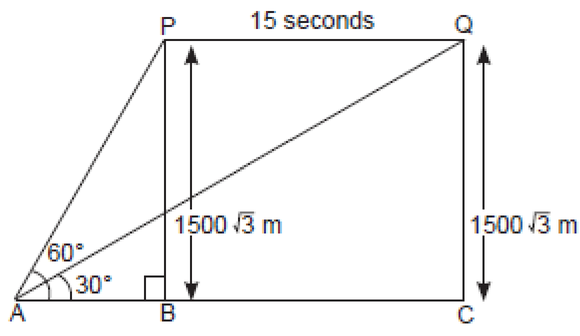
Now in 30 s, distance covered = 6000 m

In 1 hour (3600 s), distance covered = $\frac{6000}{30} \times \frac{3600}{1000}\ km$ = 720 km

Speed of the aero plane = 720 km/h.

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

ANS: Let plane is at P. After 15 seconds it reaches at Q



Distance covered in 15 seconds = PQ

In right Δ PBA, $\frac{PB}{AB}$ = tan 60°

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

⇒ AB = 1500 m

In right Δ QCA,

$\frac{QC}{AC}$ = tan 30°

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

⇒ AC = 4500 m

BC = AC – AB = 3000 m

Also PQ = BC

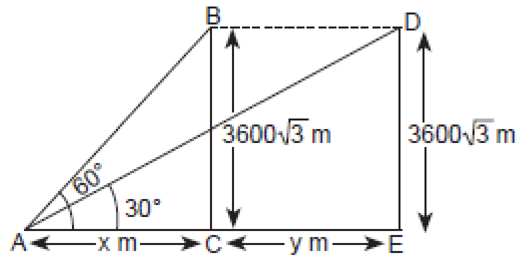
PQ = 3000 m

Speed = $\frac{D}{T}$

Speed = $\frac{300}{15} = 200 m/s$

$= 200 \times \frac{3600}{1000}\ km/hr$ = 720 km/hr

23 The angle of elevation of an aeroplane from a point A on the ground is 60°. After a flight of 30 seconds, the angle of elevation changes to 30°. If the plane is flying at a constant height of $3600\sqrt{3}$ m, find the speed in km/hr of the plane.



ANS: Let AC = x m and CE = y m

In rt. Δ ACB, tan 60° = $\frac{BC}{AC}$

$\sqrt{3} = \frac{3600\sqrt{3}}{x}$

⇒ x = 3600 m

Now, In right ΔAED,

tan 30° = $\frac{DE}{AE}$

$\frac{1}{\sqrt{3}} = \frac{3600\sqrt{3}}{3600+y}$

3600 + y = 10800

y = 7200 m

BD = CE

BD = 7200 m

Distance covered in 30 seconds = 7200 m

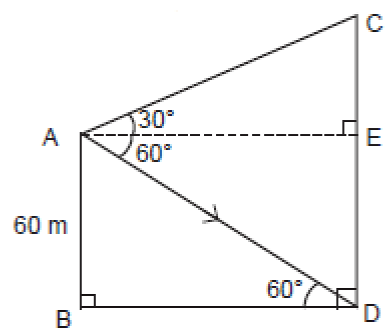
So, Speed = $\frac{7200}{30}$ = 240 m/s.

= 240 ×$\frac{18}{5}$ = 864 km/hr.

24 The angles of elevation and depression of the top and bottom of a light-house from the top of a 60 m high building are 30° and 60° respectively. Find

(i) the difference between the heights of the light-house and the building.

(ii) the distance between the light-house and the building.



AB = 60 m and CD is the light house.

∠ EAC = 30° and ∠ EAD = 60°

∠ ADB = 60°

AE ∥ BD

In right Δ ABD, $\frac{BD}{AB} = cot60° \Rightarrow BD = \frac{60}{\sqrt{3}} = 20\sqrt{3}\, m$

Now In right Δ CEA, tan 30° = $\frac{CE}{AE}$

$\frac{1}{\sqrt{3}} = \frac{CE}{20\sqrt{3}} \Rightarrow CE = 20m$

CE = 20 m

(i) Difference between the heights of the light house and the building = CE = 20 m.

(ii) The distance between the light house and the building = BD = $20\sqrt{3}$ m

25 From the top of a building 15 m high, the angle of elevation of the top of a tower is found to be 30°. From the bottom of the same building, the angle of elevation of the top of the tower is found to be 45°. Determine the height of the tower and the distance between the tower and the building.

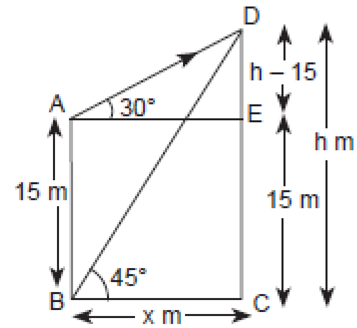
ANS: Given: A building AB 15 m high and tower CD

Angle of elevation DAE = 30°

Angle of elevation DBC = 45°

To find: BC and CD

Solution: In right ΔDEA,



$\frac{DE}{x}$ = tan 30° [AE = BC = x m]

$\Rightarrow \frac{h-15}{x} = \frac{1}{\sqrt{3}}$

$\Rightarrow$ h – 15 = $\frac{x}{\sqrt{3}}$ ...(i)

In right ΔDCB, $\frac{h}{x}$ = tan 45°

h = x m ... (ii)

Putting the value of h from equation (ii) in equation (i)

x – 15 = $\frac{x}{\sqrt{3}}$ [From (i)]

$15 = x - \frac{x}{\sqrt{3}}$

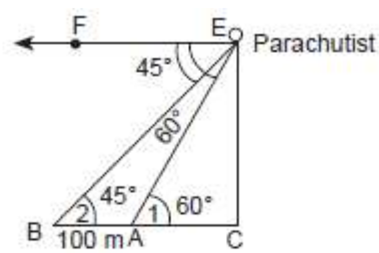
$$15 = \left(1 - \frac{\sqrt{3}}{3}\right)x$$
$$45 = (3 - 1.732)x$$
$$x = 35.49$$

x = 35.49 m

Putting in (ii) h = 35.49 m

26 A parachutist is descending vertically and makes angles of depression of 45° and 60° at two observation points 100 m apart from each other on the left side of himself. Find, in metres, the approximate height from which he falls and also find, in metres the approximate distance of the point where he falls on the ground from the first observation point.

ANS: Given: A parachutist descending a certain height



∠ FEB = 45°, ∠ FEA = 60°

To find: EC and BC

Solution: In right ΔECB

EF || BC [Given]

∠ 2 = 45° [Alternate angles]

$\frac{EC}{BC}$ = tan 45°

EC = BC ...(i)

In right ΔECA, ∠ 1 = ∠ FEA = 60° [Alternate angles]

$\frac{EC}{AC}$ = tan 60°

EC = $\sqrt{3}$ AC

BC = $\sqrt{3}$ (BC – AB) [AC = BC – AB]

BC = $\sqrt{3}$ BC – $\sqrt{3}$ × 100

$\sqrt{3}$ × 100 = $\sqrt{3}$ BC – BC

$\Rightarrow$ $\sqrt{3}$ × 100 = ($\sqrt{3}$ – 1)BC

$\Rightarrow \; BC = \frac{100\sqrt{3}}{(\sqrt{3}-1)}$

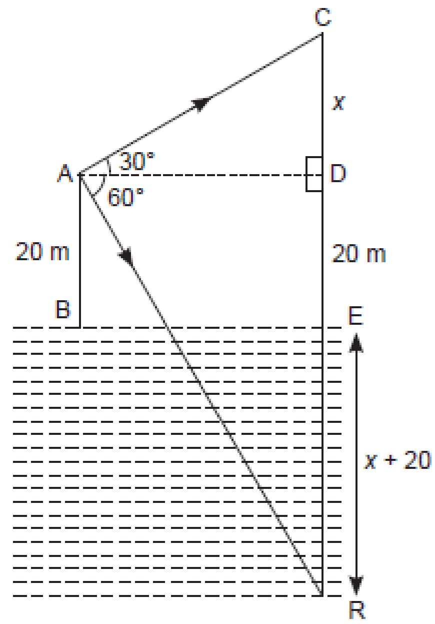
$\Rightarrow$ BC = 50 (3 + 1.732)

= 50 × 4.732 m = 236.6 m

From (i) EC = 236.6 m

27 At a point A, 20 metres above the level of water in a lake, the angle of elevation of a cloud is 30°. The angle of depression of the reflection of the cloud in the lake, at A is 60°. Find the distance of the cloud

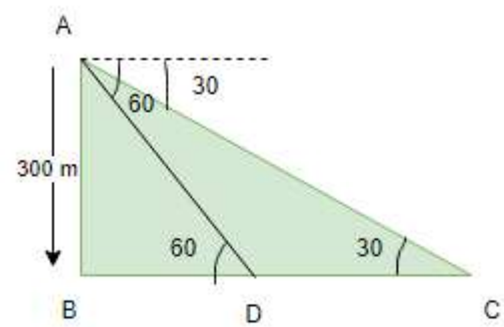
from A.
Let C is cloud and R is its reflection.
∠ DAC = 30°, ∠ DAR = 60°, let CD = x m
Height of the cloud above the lake
= (x + 20) m
ER = (20 + x) m.
Now In right Δ ADC,



$\frac{CD}{AD} = tan30° \Rightarrow \frac{x}{AD} = \frac{1}{\sqrt{3}}$

$\Rightarrow AD = \sqrt{3}\,x$
In Δ ADR , $\frac{DR}{AD} = tan60°$
$\frac{DE+ER}{AD} = \sqrt{3}$
$\frac{20+20+x}{\sqrt{3}x} = \sqrt{3}$
40 + x = 3x
⇒ x = 20 m
Now In right Δ ADC, $\frac{AC}{Cd}$ = cosec 30°
$\frac{AC}{20}$ = 2 ⇒ AC = 40 m
Distance of the cloud from A = 40 m

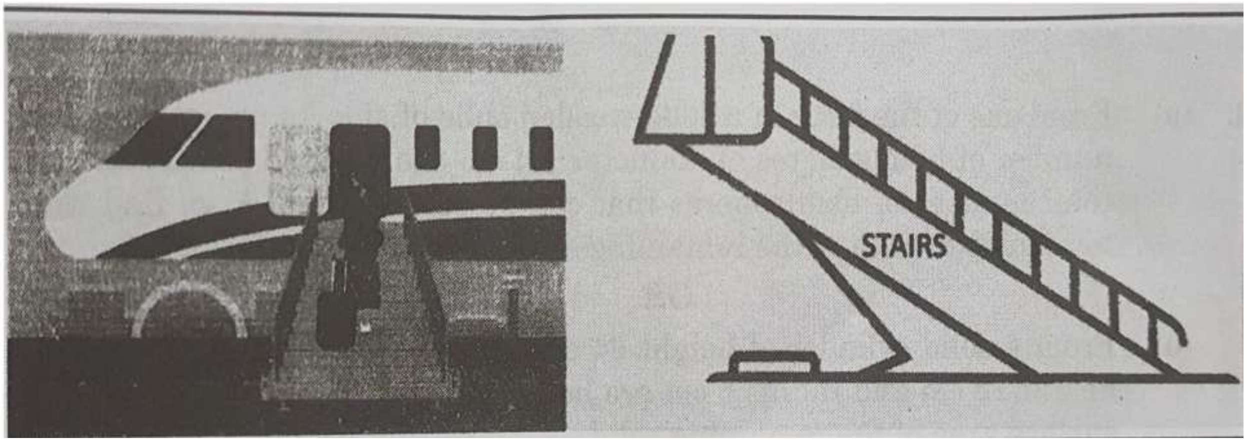
28 A highway leads to the foot of 300 m high tower. An observatory is set at the top of the tower. It sees a car moving towards it at an angle of depression of 30°. After 15 seconds angle of depression becomes 60°.
(a) Find the distance travelled by the car during this time.
(b) How this observatory is helpful to regulate the traffic on the highway?
a) Let AB = 300 m is the tower. Initially car is at C and after 15 seconds it reaches at D.



In right Δ ABC,
$\frac{AD}{BC}$ = tan 30°
$\frac{300}{BC} = \frac{1}{\sqrt{3}}$
BC = $300\sqrt{3}$ m
In right Δ ABD,
$\frac{AB}{BD}$ = tan 60°
$\frac{300}{BD} = \sqrt{3}$
BD = $\frac{300}{\sqrt{3}}$
Distance covered by car = DC = BC – BD =

$300\sqrt{3} - \frac{300}{\sqrt{3}} = \frac{600}{\sqrt{3}} = 200\sqrt{3}m$

29 Passengers boarding stairs, sometimes referred to as boarding ramps, stair cars or air craft steps, provide a mobile means to travel between the air craft doors and the ground. Larger air craft have door sills 5 to 20 feet (1 foot = 30 cm) high. Stairs facilitate safe boarding and de- boarding. CBSE AJMER 2025



An air craft has a door sill at a height of 15 feet above the ground. A stair car is placed at a horizontal distance of 15 feet from the plane.

Based on the given information, answer the following questions given in part (i) and (ii).

(i) Find the angle at which the stairs are inclined to reach the door sill 15 feet high above the ground.

(ii) Find the length of the stairs used to reach the door sill.

Further, answer any **one** of the following questions

(iii) (a) If the 20 feet long stairs is inclined at an angle of $60°$ to reach the door sill, then find the height of the door sill above the ground ($\sqrt{3} = 1.732$)

OR

(b) What should be the shortest possible length of the stairs to reach the door sill of the plane 20 feet above the ground , if the angle of elevation cannot exceed $30°$? Also find the horizontal distance of base of the stair car from the plane.

ANS: (i) $45°$

(ii) $15\sqrt{2}\,m$

(iii) (a) $10\sqrt{3}\,m = 10 \times 1.732 = 17.32m$

(iii) (b) 40 ft , 34.64 ft.