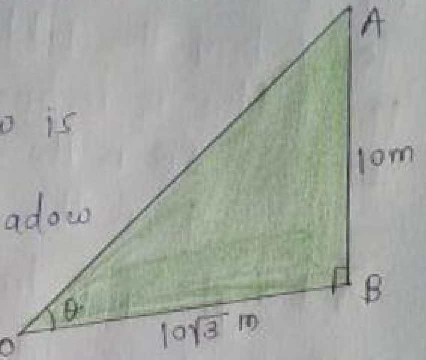
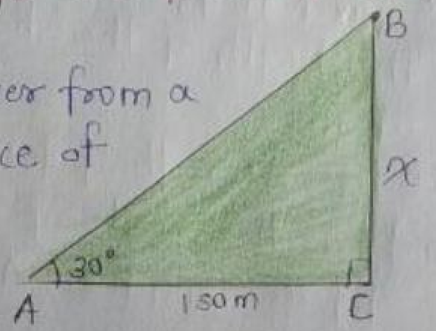
Chapter 20.
Height and Distance

1.) An electric pole is 10m high. If its shadow is $10\sqrt{3}$ m in length, find the elevation of the sun.



→ Given that,
An electric pole is 10m high and its shadow is $10\sqrt{3}$m in length.
In fig. AB is the pole and OB is the shadow of pole.
⇒ AB = 10m and OB = $10\sqrt{3}$ m
and θ is the angle of elevation of the sun.
We have, $\tan\theta = \frac{AB}{OB} = \frac{10}{10\sqrt{3}} = \frac{1}{\sqrt{3}}$
$\theta = \tan^{-1}(1/\sqrt{3}) = 30°$ $\boxed{\theta = 30°}$ is the required elevation of the sun.

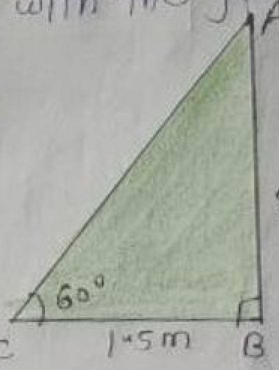
2.) The angle of elevation of the top of tower from a point on the ground and at a distance of 150 from its foot is 30°. Find the height of the tower correct to one place of decimal.



→ Given that,
The angle of elevation of the top of tower from a point on the ground and at a distance of 150m from its foot is 30°.
In fig. BC is the tower of hight x.
A is the point on ground so that $\angle BAC = 30°$ and AC = 150m
We have, $\tan\theta = \frac{BC}{AC} = \frac{x}{150}$
$\tan 30° = x/150$ ⇒ $\frac{1}{\sqrt{3}} = \frac{x}{150}$
$x = 150/\sqrt{3}$
($x = 86.6$m is the height of tower) $\boxed{x = 50\sqrt{3} \text{ m}}$

3) A ladder is placed against a wall such that it just reaches the top of the wall. The foot of the ladder is 1.5 m away from the wall and the ladder is inclined at an angle of 60° with the ground. Find the height of the wall.

→ Given that,
A ladder is placed against a wall so that it reaches the top of the wall.
The foot of the ladder is 1.5m away from the wall &
the ladder is inclined at an angle of 60° with the ground.



In fig. AB is the wall of height 'x'.
AC is the ladder and $BC = 1.5\,m$

And angle of inclination ⇒ $\angle ACB = 60°$

Then, $\tan\theta = \frac{AB}{BC}$

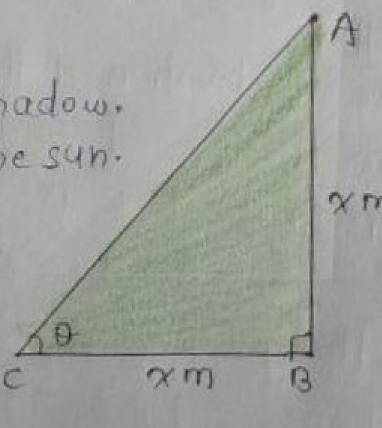
$\tan 60° = \frac{x}{1.5}$

$\sqrt{3} = x/1.5$ ⇒ $x = \sqrt{3} \times 1.5 = 1.732 \times 1.5$

$\boxed{x = 2.6m}$ is the required height of the wall

4.) What is the angle of elevation of the sun when the length of the shadow of a vertical pole is equal to its height.

→ Given that,
The length of the shadow of a vertical pole is equal to its height.



In fig. AB is the pole & BC is its shadow.
And θ is the angle of elevation of the sun.
Let us consider, $AB = BC = x\,m$

We have, $\tan\theta = \frac{AB}{BC} = \frac{x}{x} = 1$

$\theta = \tan^{-1}(1)$

$\boxed{\theta = 45°}$

is the required angle of elevation of the sun.

5) From a point P on level ground, the angle of elevation of the top of a tower is 30°. If the tower is 100m high, how far is P from the foot of the tower?

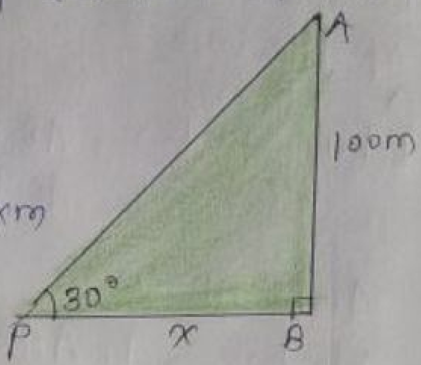
→ Given that,

A point P on ground level, the angle of elevation of the top of a tower is 30°.

And the tower is 100 m high.

In fig. AB is the tower ⇒ AB = 100m

P is the point on ground at a distance of x m from the ground. ⇒ PB = x m



And $\theta = 30°$

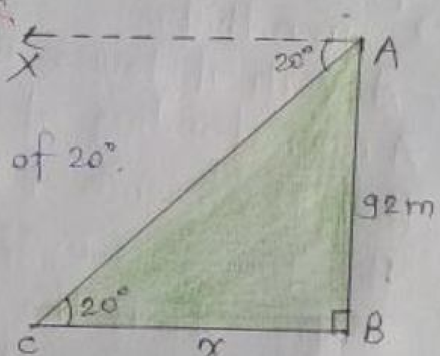
We have, $\tan\theta = \frac{AB}{PB} = \frac{100}{x}$

$\tan 30° = \frac{100}{x}$

$\frac{1}{\sqrt{3}} = \frac{100}{x} \Rightarrow x = \sqrt{3} \times 100 = 1.732 \times 100$

$\boxed{x = 173.2m}$ is the required distance betn point P and foot of the tower.

6) From the top of a cliff 92m high, the angle of depression of a buoy is 20°. Calculate the nearest meter, the distance of the buoy from the foot of the cliff.



→ In fig. AB is the cliff ⇒ AB = 92m

C is the point making depression angle of 20°.

∴ ∠ACB = 20°

Let us consider distance BC = x m

Then, In △ABC $\cot\theta = \frac{BC}{AB}$

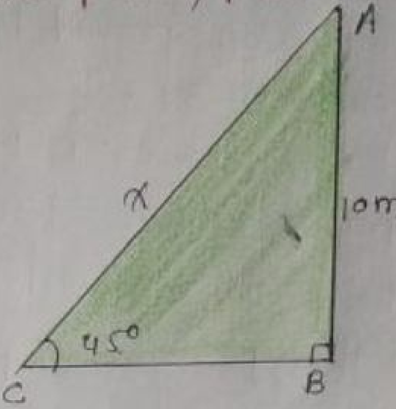
$\cot 20° = x/92 \Rightarrow \boxed{x = 92 \cot 20°}$

$x = 92 \times 2.7475$

$\boxed{x = 252.77m}$

is the required distance of the buoy from the foot of the cliff.

8.) An electric pole is 10m high A steel wire tied to the top of the pole is affixed at a point on the ground to keep the pole upright. If the wire makes an angle of 45° with the horizontal through the foot of the pole, find the length of the wire?



→ In fig.

Let us consider, AB be the pole &

AC be the wire. ∴

And AB = 10m, AC = x m

We have, In ΔABC,

$\sin\theta = \frac{AB}{AC} = \frac{10}{x}$

$\sin 45° = \frac{10}{x} \Rightarrow x = \frac{10}{1/\sqrt{2}} = \sqrt{2}\times 10 = 1.414\times 10 = 14.14m.$

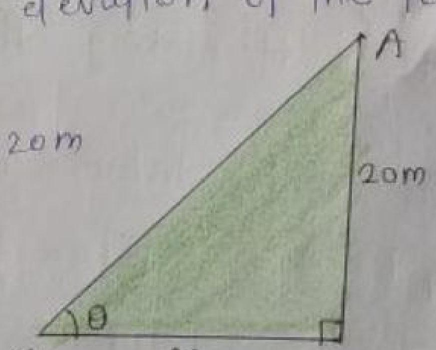
$\boxed{x = 14.14m}$ is the required length of the wire.

9.) A vertical tower is 20m high. A man standing at some distance from the tower knows that the cosine of the angle of elevation of the top of the tower is 0.53. How far is the standing from the foot of the tower?

→ Given that,

A vertical tower is 20m high.

A man standing at some distance from the tower knows that the cosine of the angle of elevation of the top of the tower is 0.53.



In fig. AB is the tower ⇒ AB = 20m

BC = x m and $\cos\theta = 0.53$

$\cos\theta = 0.53$

$\theta = \cos^{-1}(0.53)$

$\boxed{\theta = 58°}$

We have, $\tan\theta = \frac{AB}{BC} \Rightarrow \tan 58° = \frac{20}{x}$

$x = \frac{20}{1.6003}$

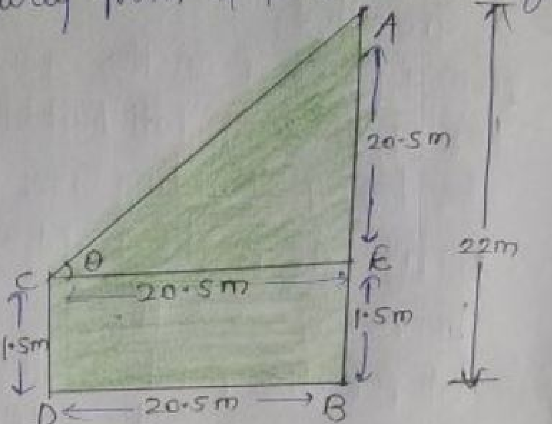
$x = 12.49 = 12.5$

$\boxed{x = 12.5m}$ is the required answer.

11.) An observer 1.5m tall is 20.5m away from a tower 22m high. Determine the angle of elevation of the top of the tower from the eye of the observer.

→ Given that,

An observer 1.5m tall is 20.5m away from a tower 22m high.



In fig. AB is the tower and CD is the observer.

$\therefore AB = 22m$, $CD = 1.5m$

$BD = 20.5$

In fig, $CE \parallel DB$ then,

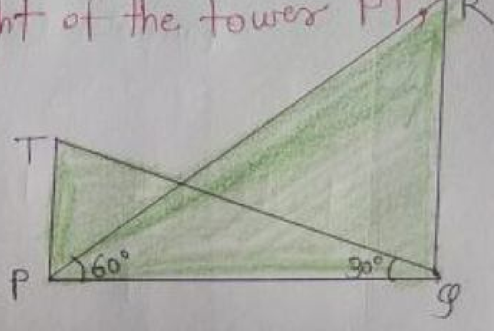
$AE = 22 - 1.5 = 20.5m$

and $CE = DB = 20.5m$

We have, $\tan\theta = \frac{AE}{CE} = \frac{20.5}{20.5} = 1 \Rightarrow \tan 45^\circ = 1$

$\Rightarrow \boxed{\theta = 45^\circ}$ is the required angle of elevation of the top of the tower from the eye of the observer.

12.) In the fig., the angle of elevation from a point P of the top of a tower QR, 50m high is 60° and that of the tower PT from a point Q is 30°. Find the height of the tower PT, correct to the nearest metre.



→ In fig. QR is the tower ⇒ QR = 50m

height of tower PT = h m

$\angle RPQ = 60^\circ$ and $\angle TQP = 30^\circ$

We have, $\tan 60^\circ = \frac{RQ}{PQ}$

$\sqrt{3} = \frac{50}{PQ} \Rightarrow \boxed{PQ = 50/\sqrt{3}\, m}$

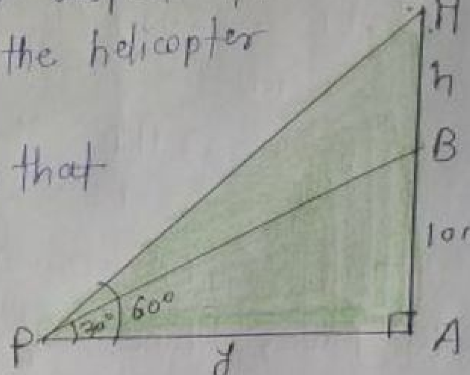
And $\tan 30^\circ = \frac{PT}{PQ}$

$PT = PQ \times \tan 30^\circ = \frac{50}{\sqrt{3}} \times \frac{1}{\sqrt{3}} = \frac{50}{3} = 16.67m$

Thus, the height of the tower PT is found to be 17m.

13) From a point P on the ground, the angle of elevation of the top of a 10m tall building and a helicopter hovering over the top of the building are 30° and 60° respectively. Find the height of the helicopter above the ground.

→ Given that,
from a point P on the ground, the angle of elevation of the top of a 10m tall building and a helicopter hovering over the top of building are 30° and 60° respectively.
In fig. AB is the building and H is the helicopter hovering over it.



Let P be the point on the ground so that
$\angle BPA = 30°$ and $\angle HPA = 60°$.
$AB = 10m$, $PA = x\,m$, $BH = h\,m$
and $PA = y\,m$.

In $\triangle ABP$, $\tan\theta = \frac{AB}{PA}$

$\tan 30° = \frac{10}{x} \Rightarrow x = \frac{10}{1/\sqrt{3}} = 10\sqrt{3}\,m$

$\Rightarrow \boxed{x = 10\sqrt{3}\,m}$

In $\triangle APH$, $\tan 60° = \frac{AH}{PA}$

$\tan 60° = (10+h)/x \Rightarrow \sqrt{3} = (10+h)/10\sqrt{3}$

$10 \times \sqrt{3} \times \sqrt{3} = 10+h$

$30 = 10+h \Rightarrow \boxed{h = 20m}$

Thus, height of the helicopter from the ground is found to be

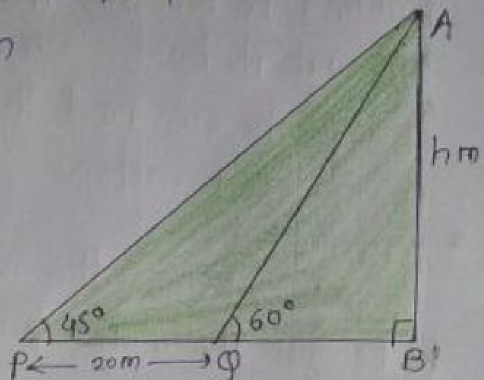
$\boxed{AH = 10+20 = 30m}$

15) A man observes the angle of elevation of the top of the tower to be 45°. He walks towards it in a horizontal line through its base. On covering 20m the angle of elevation changes to 60°. Find the height of the tower correct to 2 significant figure.

→

Let us consider, AB is the height of tower $\Rightarrow AB = h\,m$.
And P, Q are the two observing points so that

$\angle APB = 45^\circ$, $\angle AQB = 60^\circ$, $PQ = 20m$



In fig. $\tan 60^\circ = \frac{AB}{QB}$

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

$\boxed{QB = h/\sqrt{3}}$

In ΔQBA, $\tan 45^\circ = \frac{AB}{PB}$

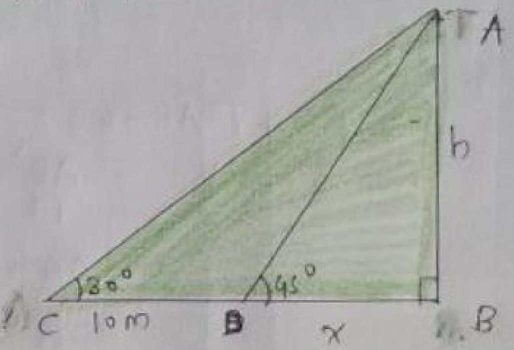
$1 = \frac{h}{(PQ+QB)} \Rightarrow h = PQ + QB$

$h = 20 + \frac{h}{\sqrt{3}} \Rightarrow h\left(\frac{\sqrt{3}-1}{\sqrt{3}}\right) = 20$

$h = \frac{20\sqrt{3}}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1} = \frac{20(3+\sqrt{3})}{2} = 10(3+1.73) = 47.3m$

Thus, the height of the tower is found to be 47.3m.

16.) The shadow of a vertical tower on a level ground increases by 10m when the altitude of the sun changes from 45° to 30°. Find the height of the tower, correct to two decimal places.



→ In fig. let AB is the tower.

Let $BD = x\,m$ and $AB = h\,m$

$\tan 45^\circ = \frac{AB}{BD} = \frac{h}{x}$

$1 = \frac{h}{x} \Rightarrow \boxed{h = x}$

In ΔABC, $\tan 30^\circ = \frac{h}{(x+10)}$

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

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

$h + 10 = \sqrt{3}h$

$\Rightarrow (\sqrt{3}-1)h = 10$

$\Rightarrow h = \frac{10}{(\sqrt{3}-1)} \times \frac{(\sqrt{3}+1)}{(\sqrt{3}+1)}$

$= \frac{10(\sqrt{3}+1)}{2}$

$= 5(\sqrt{3}+1) = 5(1.73+1)$

$h = 5 \times 2.73$

$\boxed{h = 13.65m}$

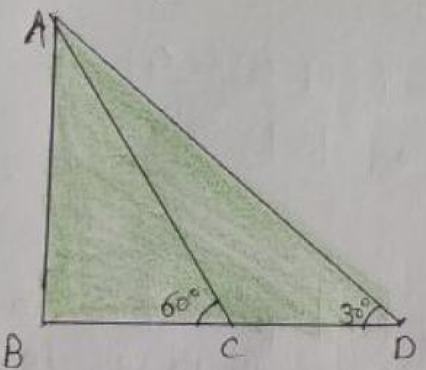
is the required height of the tower.

18.) A man observes the angles of elevation of the top of a building to be 30°. He walks towards it in a horizontal line through its base. On covering 60m the angle of elevation changes to 60°. Find the height of the building correct to the nearest metre.

→ Given that,
A man observes the angles of elevation of the top of a building
to be 30°. He walks towards it in a horizontal line through
its base.
And on covering the distance of 60m the angle of elevation
changes to 60°.

In fig., AB is the building.

$CD = 60\,m$



In ΔABC, $\tan 60° = \frac{AB}{BC}$

$\sqrt{3} = AB/BC$

$\Rightarrow BC = \cancel{\sqrt{3}}\,AB/\sqrt{3}$

$\boxed{BC = AB/\sqrt{3}}$ — ①

In ΔABD,

$\tan 30° = \frac{AB}{BD}$

$\frac{1}{\sqrt{3}} = \frac{AB}{(BC+60)} \Rightarrow BC+60 = \sqrt{3}AB$

$\Rightarrow BC = \sqrt{3}AB - 60$ — ②

from ① & ② $\Rightarrow$ $\frac{AB}{\sqrt{3}} = \sqrt{3}AB - 60$

$AB = 3AB - 60\sqrt{3}$

$60\sqrt{3} = 2AB$

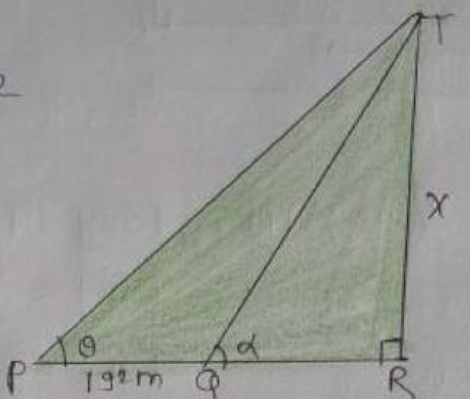
$AB = 30\sqrt{3} = 30 \times 1.732 = 51.96\,m$

$\boxed{AB = 51.96m}$

Thus, the height of the building is found to be 51.96m.

19.) At a point on level ground, the angle of elevation of a vertical lower is found to be such that its tangent is 5/12. On walking 192m towards the tower, the tangent of the angle is found to be 3/4. Find the height of the tower.

→ In fig.



Let us consider,

TR be the tower and $\tan\theta = 5/12$

$\tan\alpha = 3/4$, $PQ = 192m$

Let us take, $TR = x$ and $QR = y$

Then, $\tan\alpha = \frac{TR}{QR} = \frac{x}{y}$

$\frac{3}{4} = \frac{x}{y}$

$\boxed{y = \frac{4}{3}x}$

In $\triangle TPR$, $\tan\theta = \frac{TR}{PR} \Rightarrow \frac{x}{(y+192)} = \frac{5}{12}$

$\Rightarrow x = (y+192) \times 5/12$

$x = (4/3\, x + 192) \times 5/12$

$\Rightarrow x = \frac{5}{9}x + 80 \Rightarrow x - \frac{5}{9}x = 80$

$\frac{4}{9}x = 80$

$4x = 720$

$\boxed{x = 180\,m}$ is the required height of the tower.

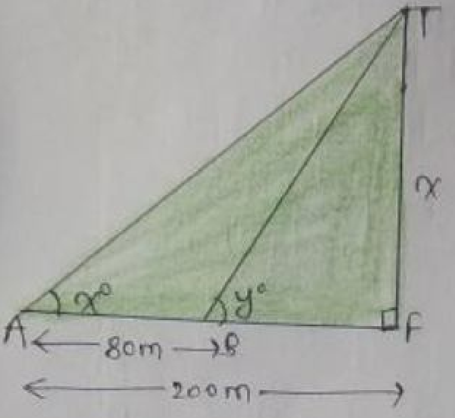
20.) In the fig. not drawn to scale. TF is a tower. The elevation of T from A is $x°$ where $\tan x = 2/5$ and $AF = 200m$. The elevation of T from B, where $AB = 80m$, is $y°$. Calculate

i) The height of the tower TF

ii) The angle y, correct to the nearest degree.

→ In fig. TF is a tower & The elevation of T from A is $x°$ where $\tan x = 2/5$ and $AF = 200m$.

The elevation of T from B, where $AB = 80m$ is $y°$.



Let us consider, the tower be TF

$TF = x$ m

$\tan x = \frac{2}{5}$, $AF = 200$m, $AB = 80$m

i) ΔATF, $\tan x^\circ = TF/AF$

$\Rightarrow \frac{2}{5} = \frac{x}{200}$

$\Rightarrow x = (2 \times 200)/5 = 400/5 = 80$m

$\boxed{x = 80m}$ is the required height of tower.

ii) In ΔTBF, $\tan y = TF/BF$

$\tan y = 80/(200-80) = 80/120$

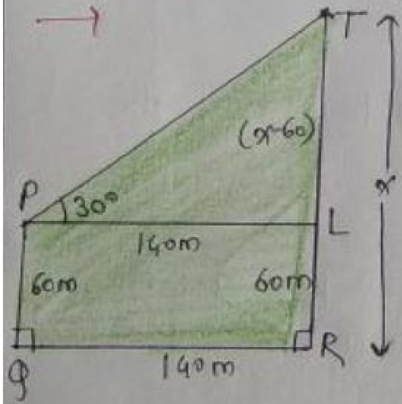
$\tan y = \frac{2}{3} = 0.6667$

$y = \tan^{-1}(0.6667) = 33^\circ 41' = 34^\circ$

$\boxed{y = 34^\circ}$ is the required angle of elevation.

22) The horizontal distance between two towers is 140m. The angle of elevation of the top of the first tower when seen from the top of the second tower is 30°. If the height of the second tower is 60m, find the height of the first tower.

→



Given that,

- The horizontal distance betn two towers is 140m.
- The angle of elevation of the top of the first tower when seen from the top of the second tower is 30°.
- And the height of the second tower is 60m.

In fig., TR is the tower $\Rightarrow TR = x$m

Height of second tower $\Rightarrow PQ = 60$m

Distance betn two tower $\Rightarrow QR = 140$m

Here, $PL \parallel QR \Rightarrow PQ = LR = 60$m

$PL = QR = 140$m

In ΔTPL, $\tan\theta = TL/PL$

$\tan 30^\circ = (x-60)/140$

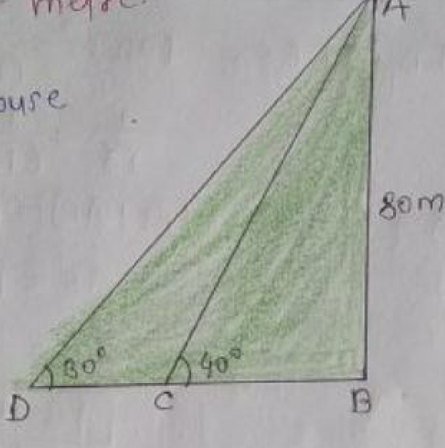
$\frac{1}{\sqrt{3}} = \frac{(x-60)}{140} \Rightarrow (x-60) = 140/\sqrt{3}$

$x - 60 = \frac{140}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{140\sqrt{3}}{3}$

$x = \frac{140\sqrt{3}}{3} + 60 = (140 \times 1.732)/3 + 60 = 80.83 + 60$

$\boxed{x = 140.83}$ is the required height of first tower.

23) As observed from the top of a 80m tall lighthouse, the angles of depression of two ships on the same side of the lighthouse in horizontal line with its base are 30° & 40° respectively. Find the distance betn two ships. Give your answer correct to nearest metre.



→ In fig.

Let us consider, AB be the lighthouse and C, D are the two ships.

In ΔADB,

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

$\frac{1}{\sqrt{3}} = \frac{80}{BD} \Rightarrow \boxed{BD = 80\sqrt{3}}$

In ΔACB, $\tan 40^\circ = \frac{AB}{BC} = \frac{80}{BC}$

$0.84 = \frac{80}{\cancel{0.84}\,BC} \Rightarrow BC = \frac{80}{0.84} = 95.25$

Now, $BD = 80\sqrt{3} = 80 \times 1.73 = 138.4$

and $DC = BD - BC = 138.4 - 95.25 = 43.15$

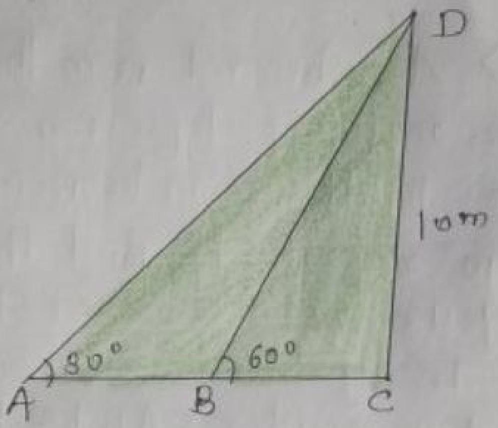
$\boxed{DC = 43.15m}$ is the required distance between two ships.

25) from the two points A and B on the same side of a building, the angles of elevation of the top of the building are $30°$ and $60°$ respectively. If the height of the building is 10m, find the distance between A and B correct to two decimal places.

→ In fig.

A and B are the points on the same side of a building. The angles of elevation of top of the building are $30°$ & $60°$ respectively.

And the height of the building is 10m.



In ΔDBC,

$\tan 60 = 10/BC$

$\sqrt{3} = 10/BC$

$\boxed{BC = 10/\sqrt{3}}$

In ΔDBC, $\tan 30° = \frac{10}{(BC+AB)}$

$$\frac{1}{\sqrt{3}} = \frac{10}{(10/\sqrt{3} + AB)}$$

$(10/\sqrt{3} + AB) = 10\sqrt{3}$

$$AB = 10\sqrt{3} - \frac{10}{\sqrt{3}} = \frac{(30-10)}{\sqrt{3}} = \frac{20}{\sqrt{3}}$$

$AB = 20/1.732 = 11.54m$

$\boxed{AB = 11.54m}$

This is the required distance betn A and B.

26.) The angles of depression of two ships A and B as observed from the top of a lighthouse 60m high are $60°$ & $45°$ respectively. If the two ships are on the opposite sides of the lighthouse, find the distance between two ships. Give your answer correct to the nearest whole number.

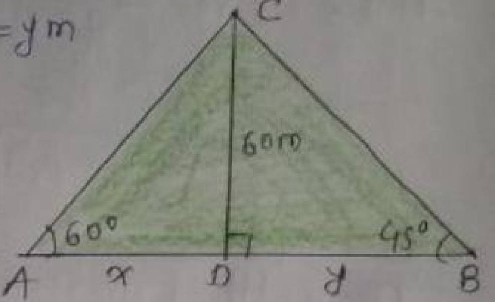
→ Given that,

The angles of depression of two ships A and B as observed from the top of a light house 60m high are $60°$ & $45°$ respectively.

Also, the two ships are on the opposite side of the lighthouse.

In fig. Let CD is the lighthouse ⇒ ∴ CD = 60m

Let us consider, AD = x m, BD = y m



Now, In ΔACD,

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

$$\sqrt{3} = \frac{60}{x} \Rightarrow x = \frac{60}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{60\sqrt{3}}{3}$$

$$x = 20\sqrt{3} = 20 \times 1.732 = 34.64m \qquad \boxed{x = 34.64m}$$

and In ΔBCD,

$$\tan 45^\circ = \frac{CD}{BD}$$

$$1 = \frac{60}{y} \Rightarrow \boxed{y = 60m}$$

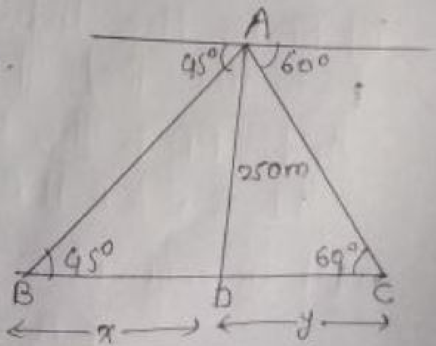
Then, distance between two ships = $x + y$
$= 34.64 + 60 = 94.64m$

Thus, the distance between two ships is found to be 95m.

27) An aeroplane at an altitude of 250m observes the angle of depression of two boats on the opposite banks of a river to be 45° & 60° respectively. Find the width of the river. Write the answer correct to nearest whole number.

→ Given that,
An aeroplane at an altitude of 250m observes the angle of depression of two boats on the opposite banks of river to be 450° & 60° respe.

In fig. AD is the height of aeroplane.
AD = 250m



B and C are the two boats.

Let us take, BD = x m and DC = y m

In ΔADB, $\cot 45^\circ = \frac{x}{250}$

$1 = x/250$

$\boxed{x = 250\,m}$

And, $\cot 60^\circ = \frac{y}{250}$

$\frac{1}{\sqrt{3}} = \frac{y}{250}$

$\boxed{y = 250/\sqrt{3}}$

The width of river is $BC = BD + DC = x + y$

$= 250 + \frac{250}{\sqrt{3}}$

$= 250(1 + 1/\sqrt{3}) = 250\left(\frac{\sqrt{3}+1}{\sqrt{3}}\right)$

$= 250\left(\frac{1.732+1}{1.732}\right)$

$= 250\left(\frac{2.732}{1.732}\right)$

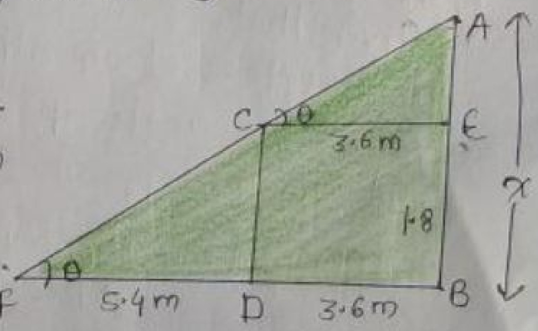
$= 250 \times 1.577$

$\boxed{BC = 394.25\,m}$

Thus, the width of the river is found to be 394m.

29.) A man 1.8 m high stands at a distance of 3.6 m from a lamp post and casts a shadow of 5.4 m on the ground. Find the height of the lamp post.

→ Given that,
A man 1.8m high stands at a distance of 3.6m from a lamp post and casts a shadow of 5.4m on the ground.



In fig. AB is the lamp post &
CD is the height of man.
Let BD be the distance of the man from the foot of the lamp.
And FD is the shadow of man.

Here, CE ∥ BD

Let us consider, $AB = x$ and $CD = 1.8m$

$EB = CD = 1.8m$

$AE = x - 1.8$, $FD = 5.4m$

In ΔACE, $\tan\theta = AE/CE$ In ΔCFD, $\tan\theta = \frac{CD}{FD}$

$\tan\theta = \frac{(x-1.8)}{3.6}$ —— ① $\tan\theta = \frac{1.8}{5.4} = \frac{1}{3}$ —— ②

from ① & ② ⇒

$$\frac{x-1.8}{3.6} = \frac{1}{3}$$

$$3(x-1.8) = 3.6$$

$$3x - 5.4 = 3.6$$

$$3x = 9$$

$\boxed{x = 3m}$ is the required height of the lamp post.

31.) A pole of height 5m is fixed on the top of a tower. The angle of elevation of the top of the pole as observed from a point A on the ground is 60° and the angle of depression of the point A from the top of the tower is 45°. Find the height of the tower. (Take $\sqrt{3} = 1.732$)

→ Given that,

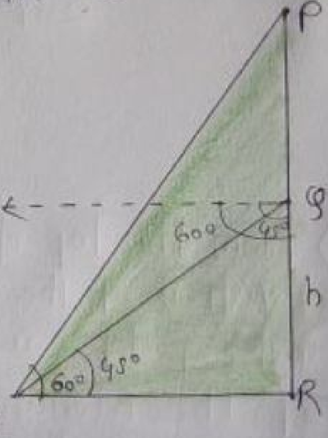
A pole of height 5m is fixed on the top of a tower.

The angle of elevation of the top of the pole as observed from a point A on the ground is 60° and the angle of depression of the point A from the top of the tower is 45°.

In fig. Let QR be the tower & PQ is the pole on it.

$\angle PAR = 60°$ & $\angle XQA = 45°$ or $\angle QAR = 45°$

$PQ = 5m$



In ΔQAR,

$\tan\theta = \frac{QR}{AR}$

$\tan 45° = h/AR$

$1 = h/AR$

$\boxed{AR = h}$

In ΔPAR,

$\tan 60° = \frac{PR}{AR}$

$\sqrt{3} = (5+h)/h$

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

$h(\sqrt{3}-1) = 5$

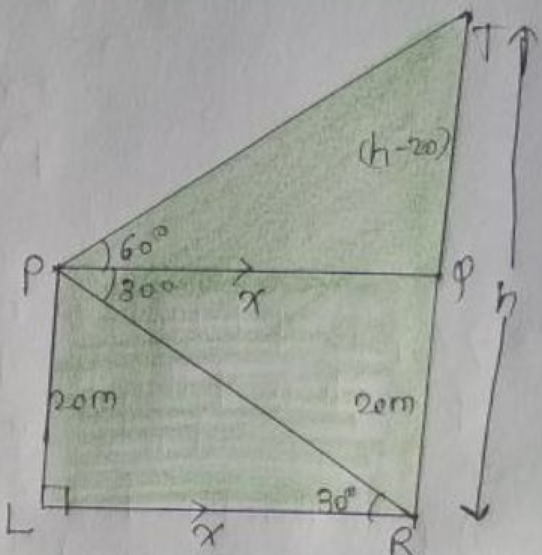
$h = 5/0.732$

$\boxed{h = 6.83}$

is the required height of the tower.

32.) A vertical pole and a vertical tower are on the same level ground. from the top of the pole the angle of elevation of the top of the tower is 60° and the angle of depression of the foot of the tower is 30°. find the height of the tower if the height of the pole is 20m.

→ In fig.



Let us consider, TR be the tower.

PL is the pole ⇒ PL = 20m

Here, PQ ∥ LR

$\angle TPQ = 60°$ and $\angle QPR = 30°$

$\angle PRL = \angle QPR = 30°$

Let us take, LR = x and TR = h

Then, $TQ = TR - QR = (h-20)\,m$

In $\triangle PRL$, $\tan\theta = PL/LR$

$\tan 30° = 20/x$

$1/\sqrt{3} = 20/x$

$\boxed{x = 20\sqrt{3}\,m}$

In $\triangle PQT$, $\tan 60° = \frac{TQ}{PQ}$

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

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

$60 = h - 20$

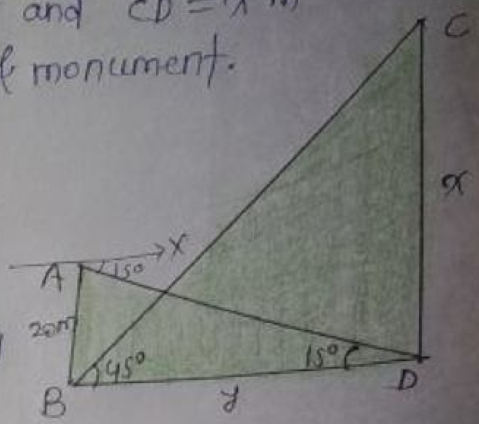
$\boxed{h = 80m}$ is the required height of the tower.

33.) from the top of a building 20m high, the angle of elevation of the top of a monument is 45° and the angle of depression of its foot is 15°. find the height of the monument.

→ Given that,

The building is 20m high, the angle of elevation of the top of a monument is 45° and the angle of depression of its foot is 15°.

In fig. Let us consider, AB is the building and AB = 20 m
Let us take CD is the monument and CD = x m
Let 'y' be the distance betn building & monument.



In ΔBCD,

$\tan\theta = \frac{CD}{BD}$

$\tan 45° = x/y$

$1 = x/y$

$\boxed{x = y}$

In ΔABD,

$\tan 15° = \frac{AB}{BD}$

$0.2679 = \frac{20}{x}$

$x = 20/0.2679$

$\boxed{x = 74.65 m}$

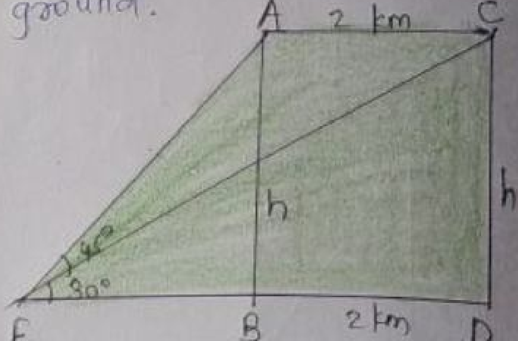
Thus, the height of the monument is found to be 74.65m.

35.) An aircraft is flying at a constant height with a speed of 360 km/h. from a point on the ground, the angle of elevation of the aircraft at an instant was observed to be 45°. After 20 seconds, the angle of elevation was observed as to be 30°. Determine the height at which the aircraft is flying.

→ Given that,
Speed of aircraft = 360 km/h

Then, distance covered in 20 sec $= \frac{360 \times 20}{60 \times 60} = 2$ km.

Let 'E' be the fixed point on the ground.
Let us take, AB = CD = h km



In fig.

$ED = EB + BD$

$\boxed{ED = h + 2}$

In ΔAEB,

$\tan\theta = \frac{AB}{EB}$

$\tan 45° = h/EB$

$1 = h/EB$

$\boxed{h = EB}$

In ΔCED,

$\tan 30° = CD/ED$

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

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

$1.732h - h = 2$

$2 = 0.732h$

$h = 2/0.732$

$\boxed{h = 2.732 m}$ is the required height of flying aircraft.