



Sahi Prep Hai Toh Life Set Hai

Trigonometry

Height & Distance

Part-1

Agenda

Basic Concepts
& Theory



(34-36) min

Questions on
Height & Distance



12 Questions

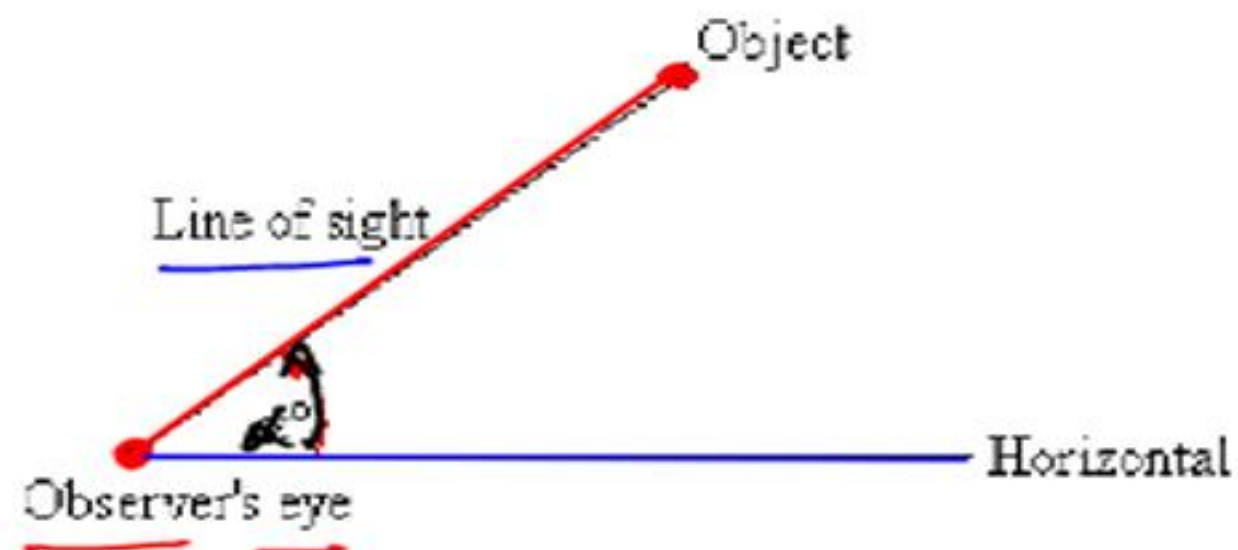
While solving questions on Height & Distance :

1. Formation of a figure
2. Solving the question

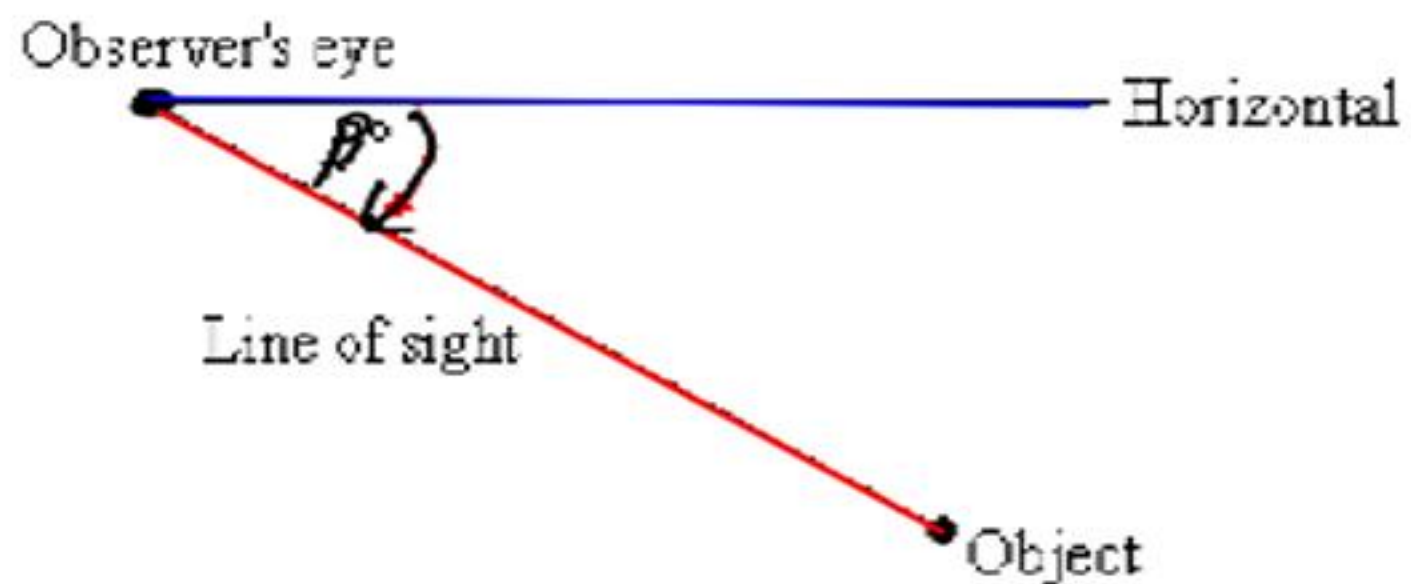


80%

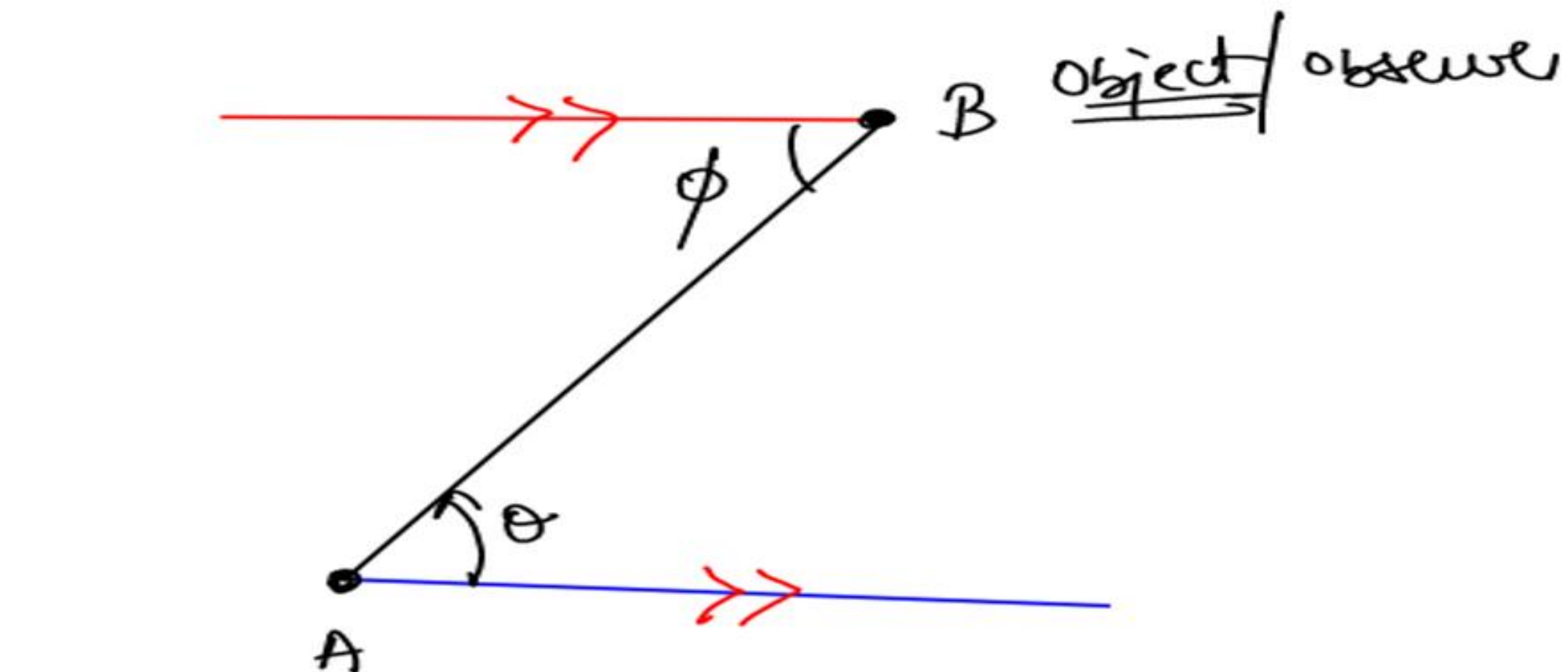
ANGLE OF ELEVATION



ANGLE OF DEPRESSION



* Angle of elevation or Angle of Depression tells you whether a object is at a lower height or at a higher height w.r.t observer

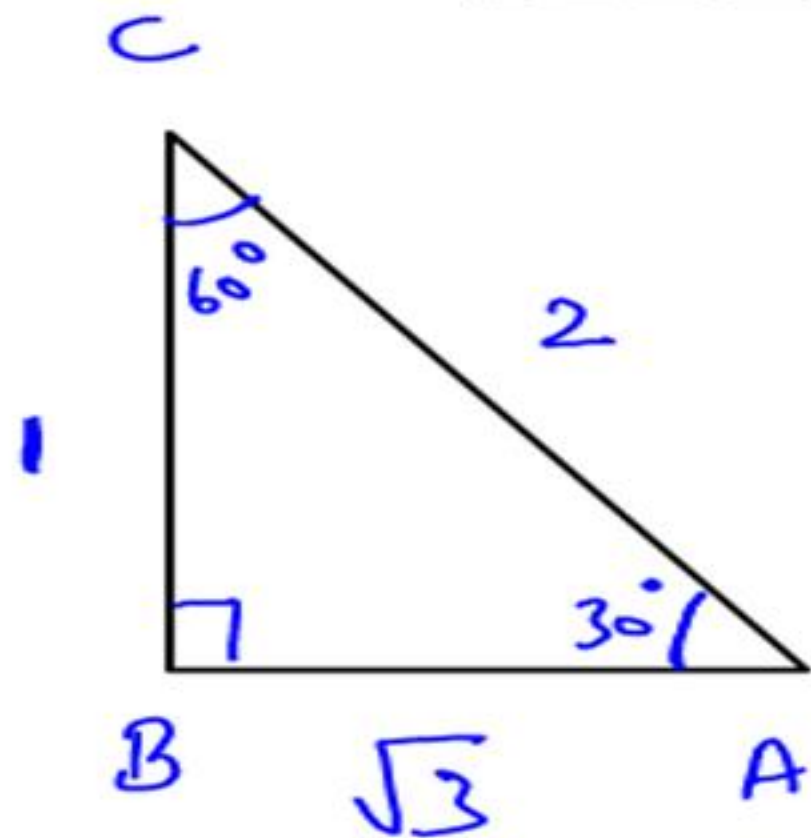


Observer / Object

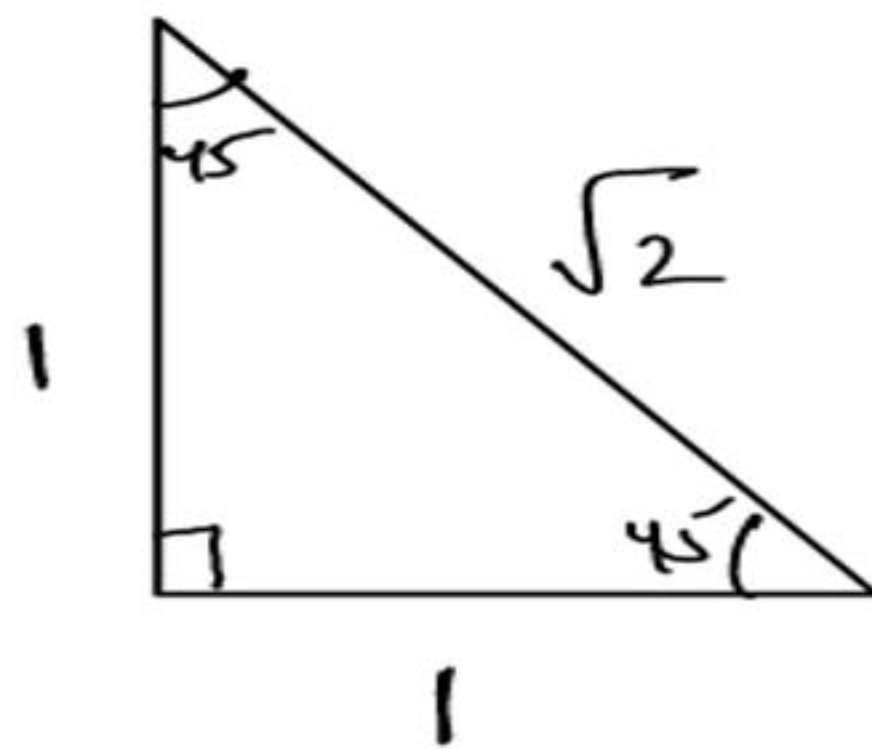
$$\boxed{\theta = \phi}$$

$\theta \rightarrow$ Angle of elevation
 $\phi \rightarrow$ Angle of depression

30-60-90 & 45-45-90 TRIANGLE



$$\sin 30^\circ = \frac{CB}{AC} = \frac{1}{2}$$



30-60-90

$$\underline{\underline{1 : \sqrt{3} : 2}}$$

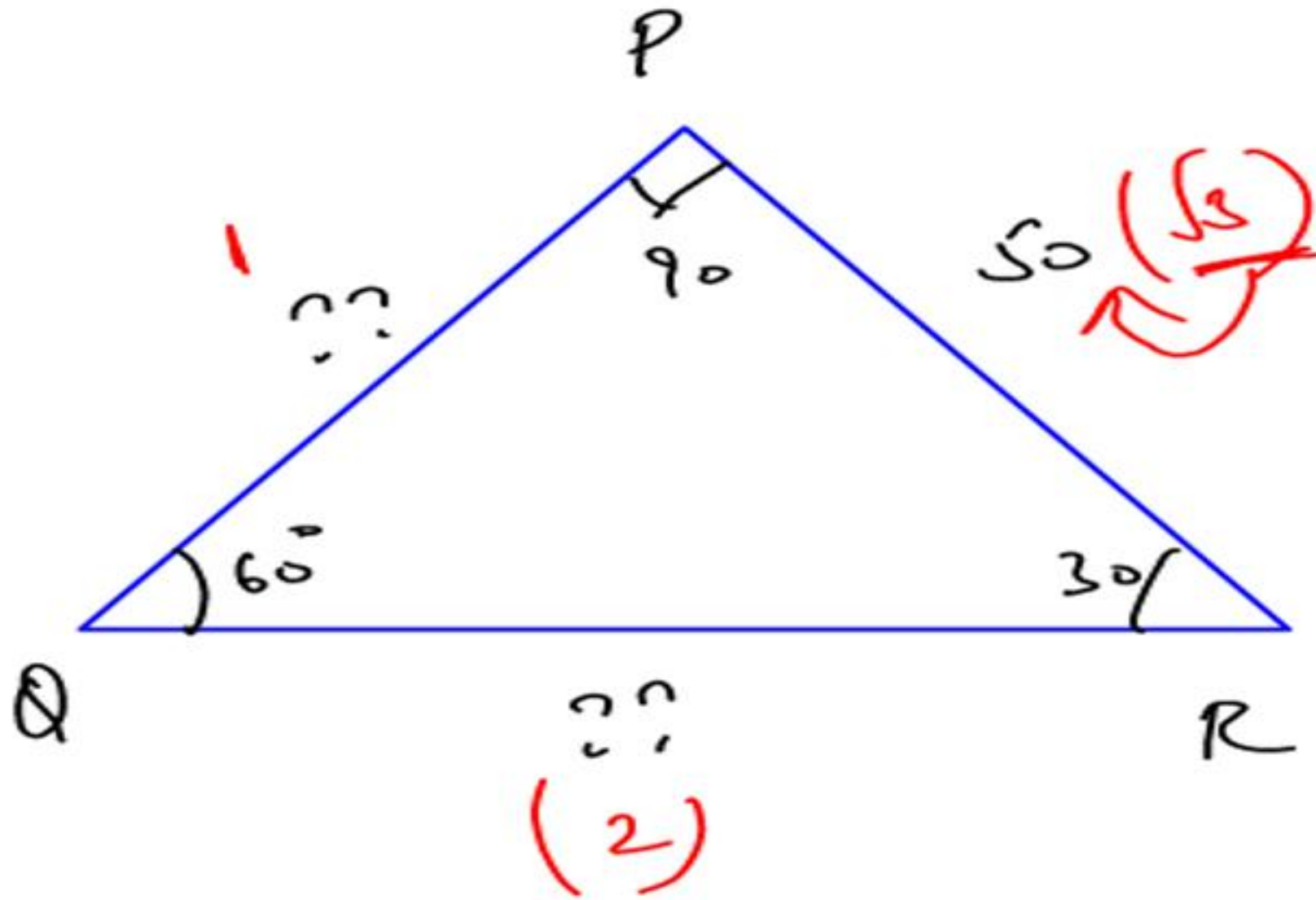
45-45-90

$$\underline{\underline{1 : 1 : \sqrt{2}}}$$



gradeup

Eg. In a $\triangle PQR$, $\angle P = 90^\circ$, $\angle Q = 60^\circ$ and $PR = 50$ m. Find QR and PQ .



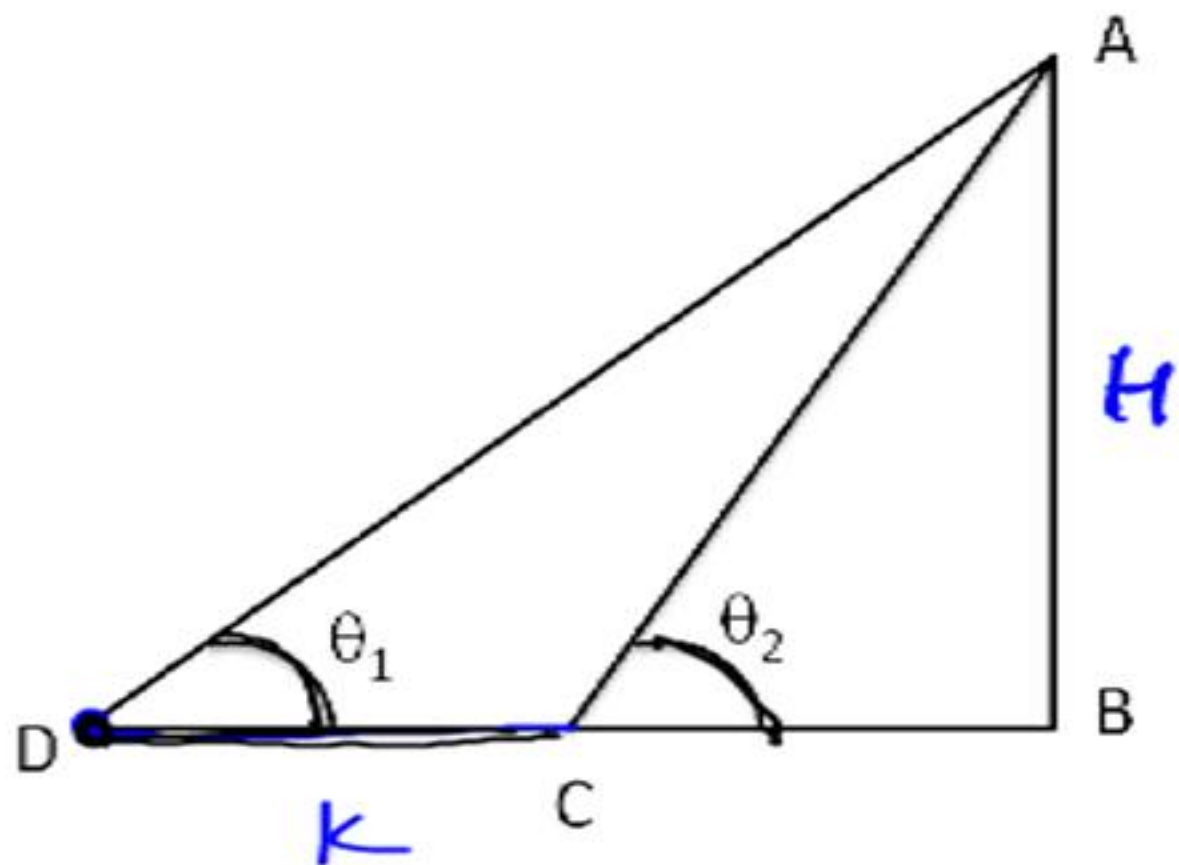
$$\sqrt{3} \rightarrow 50$$

$$1 \rightarrow \frac{50}{\sqrt{3}}$$

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

$$QR = \frac{100}{\sqrt{3}}$$

A very common question in the exam:



$$\tan \theta_1 = \frac{H}{BC+K} \quad \cot \theta_1 = \frac{BC+K}{H} \quad \text{--- (1)}$$

$$\tan \theta_2 = \frac{H}{BC} \quad \cot \theta_2 = \frac{BC}{H} \quad \text{--- (2)}$$

$$\cot \theta_1 - \cot \theta_2 = \frac{K}{H}$$

$$\checkmark \checkmark \quad H = \frac{K}{\cot \theta_1 - \cot \theta_2}$$

If a person has walked k units towards a tower and the angle of elevation changes from θ_1 to θ_2 then the height of the tower:

Ans

$$H = \frac{k}{\cot \theta_1 - \cot \theta_2}$$



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Eg. At a point on level ground, the angle of elevation of a vertical tower is found to be such that its tangent is $\frac{5}{12}$. On walking 192 metres towards the tower, the tangent of the angle of elevation is $\frac{3}{4}$. Find the height of the tower.

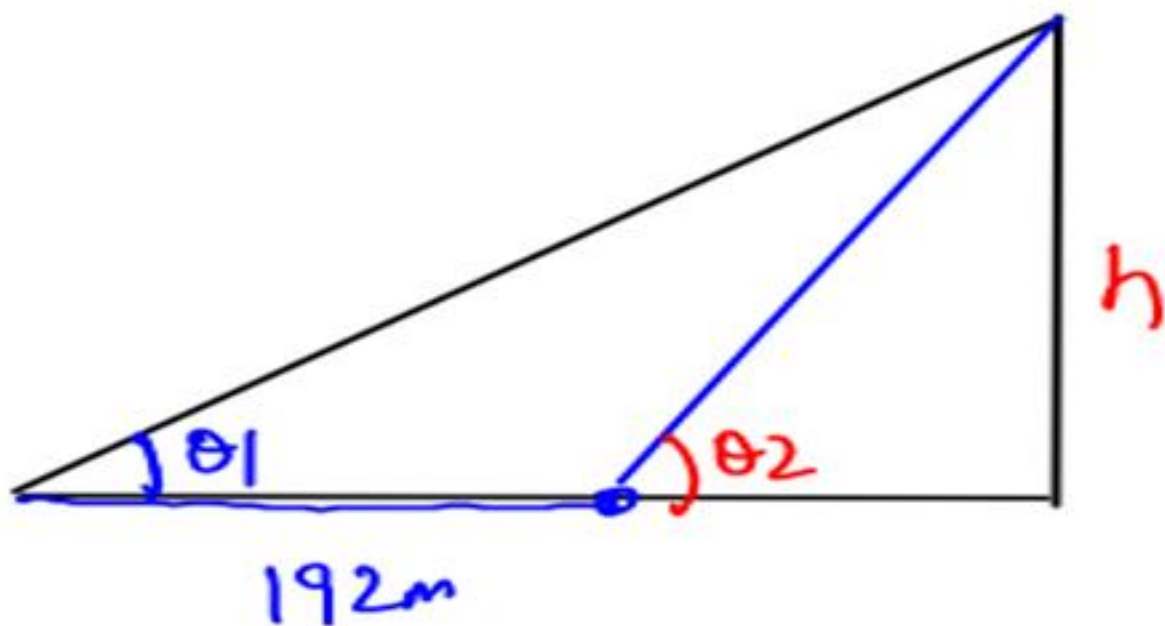
(a) 120 m

(c) 200 m

☒ (b) 180 m

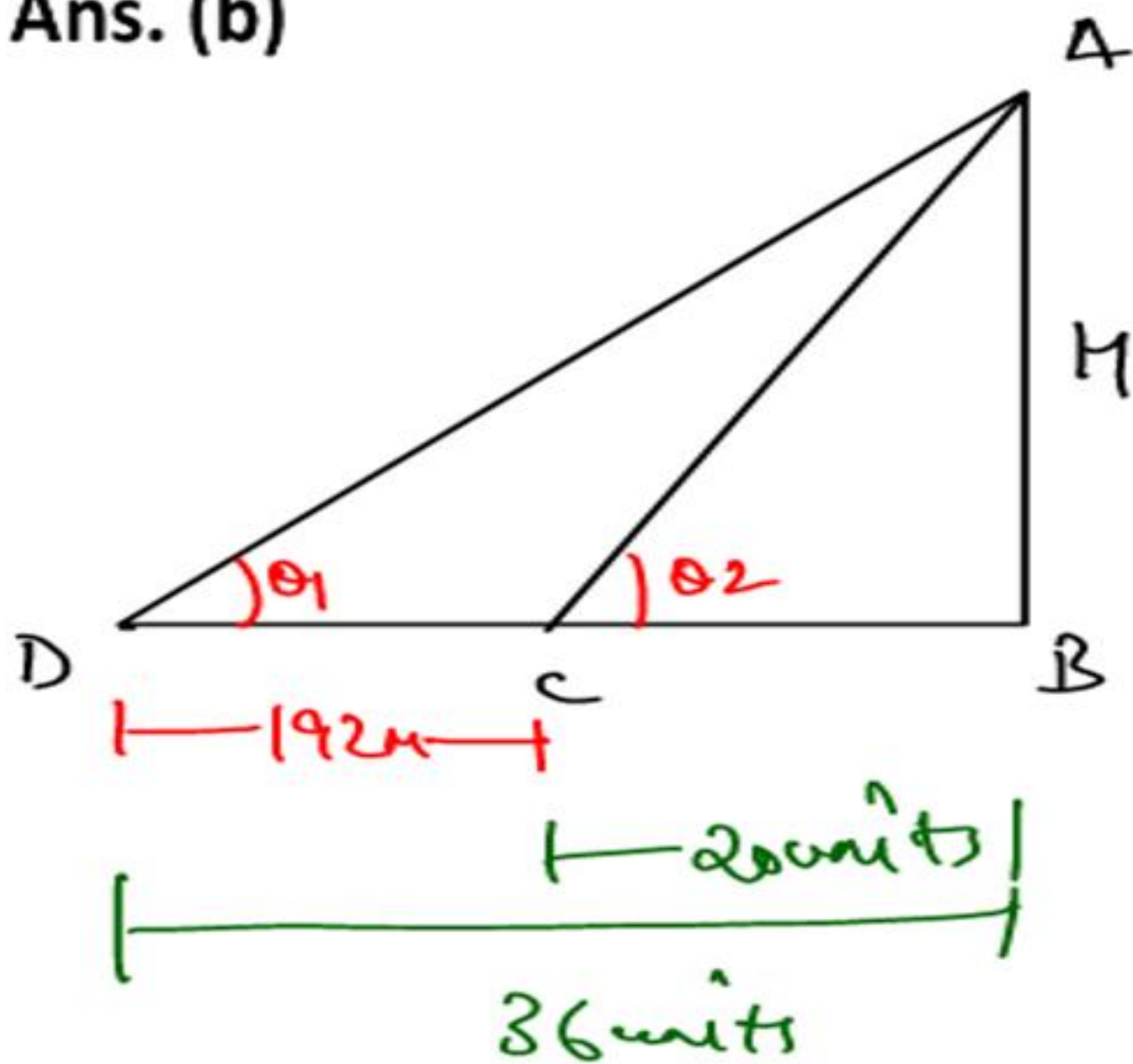
(d) 220 m

$$\tan \theta_1 = \frac{5}{12} \quad \tan \theta_2 = \frac{3}{4}$$



$$\begin{aligned} h &= \frac{192}{\frac{12}{5} - \frac{4}{3}} \\ &= \frac{12 \cancel{192} \times 15}{\cancel{16}} \end{aligned}$$

Ans. (b)



$$\tan \theta_1 = \frac{5}{12} \quad \tan \theta_2 = \frac{3}{4}$$

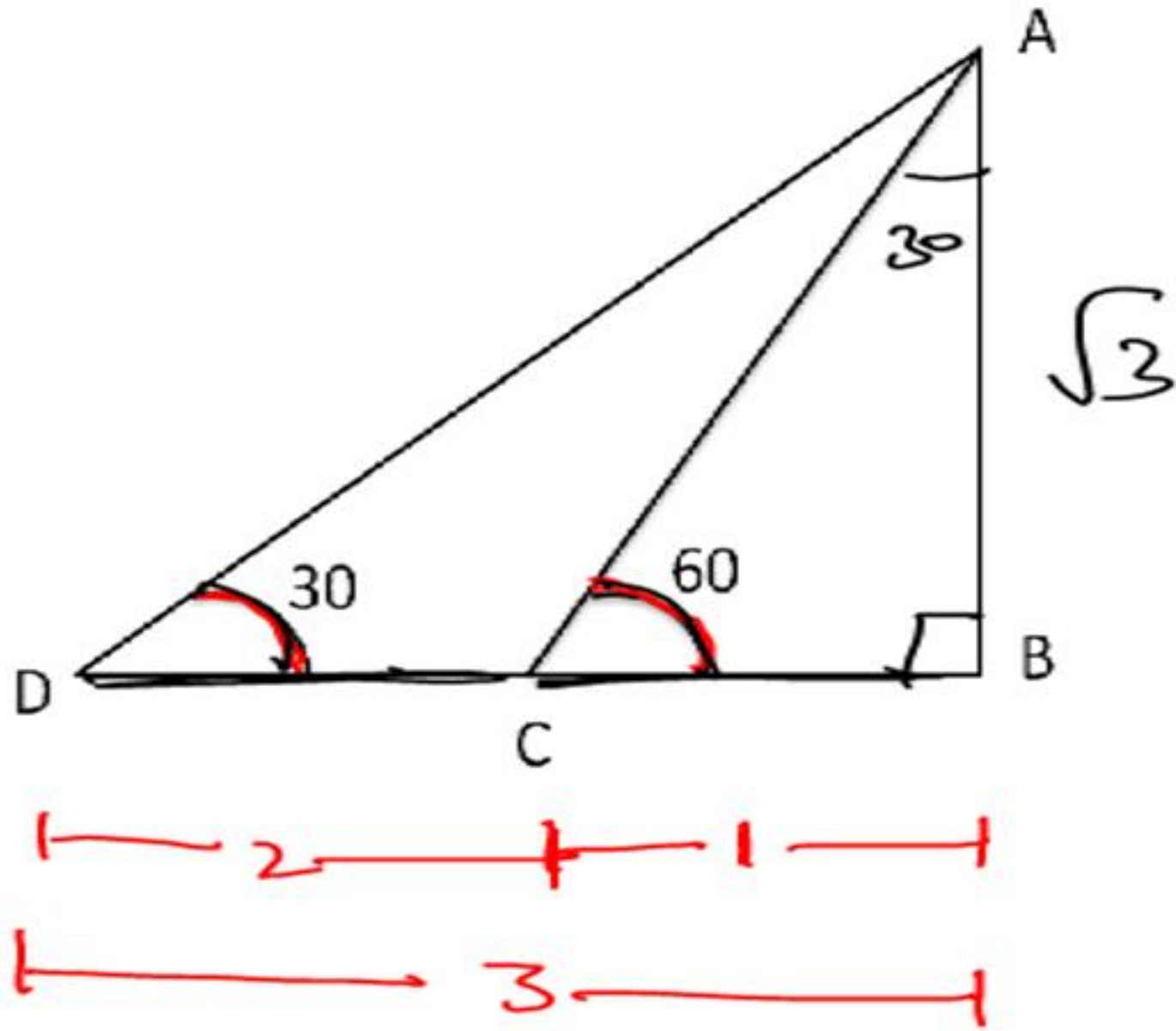
$$\frac{H}{BD} = \frac{5}{12} \times 3 = \frac{15}{36}$$

$$\frac{H}{BC} = \frac{3}{4} \times 5 = \frac{15}{20}$$

$$16 \text{ units} \rightarrow 192$$

$$1 \rightarrow 12$$

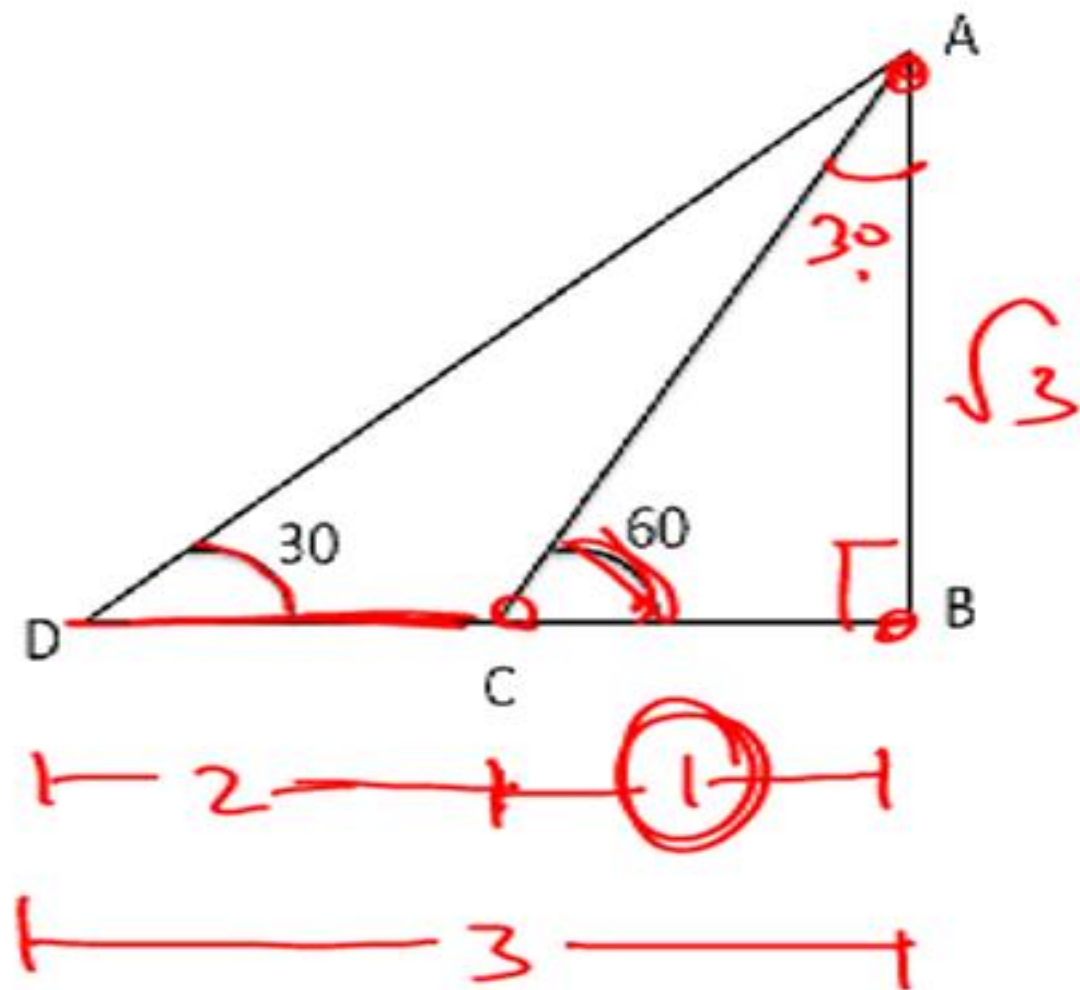
$$H = 180m$$



$$\tan 60^\circ = \frac{AB}{BC} \quad \text{--- (1)}$$

$$\tan 30^\circ = \frac{AB}{BD} \quad \text{--- (2)}$$

$$3 = \frac{BD}{BC}$$

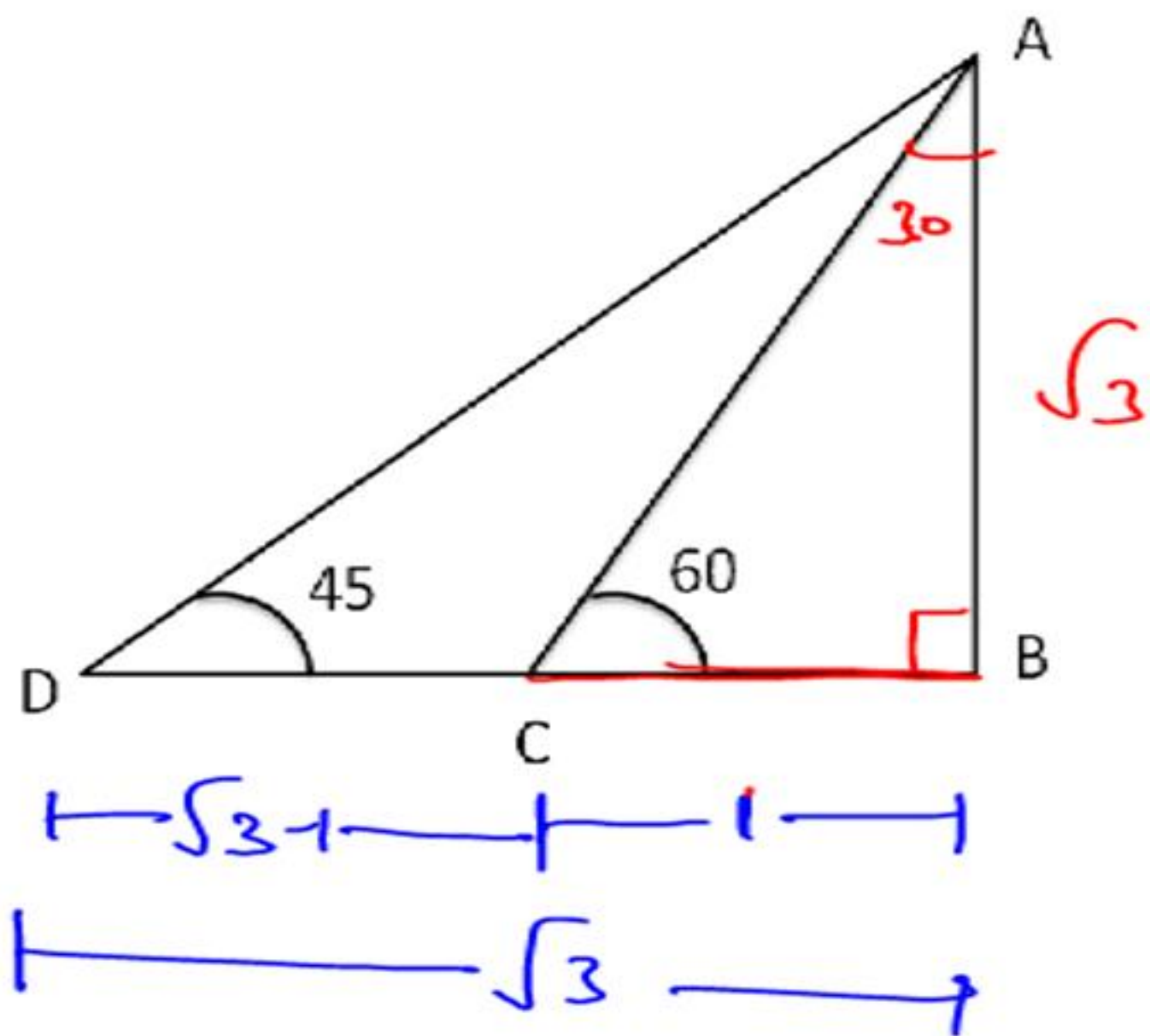


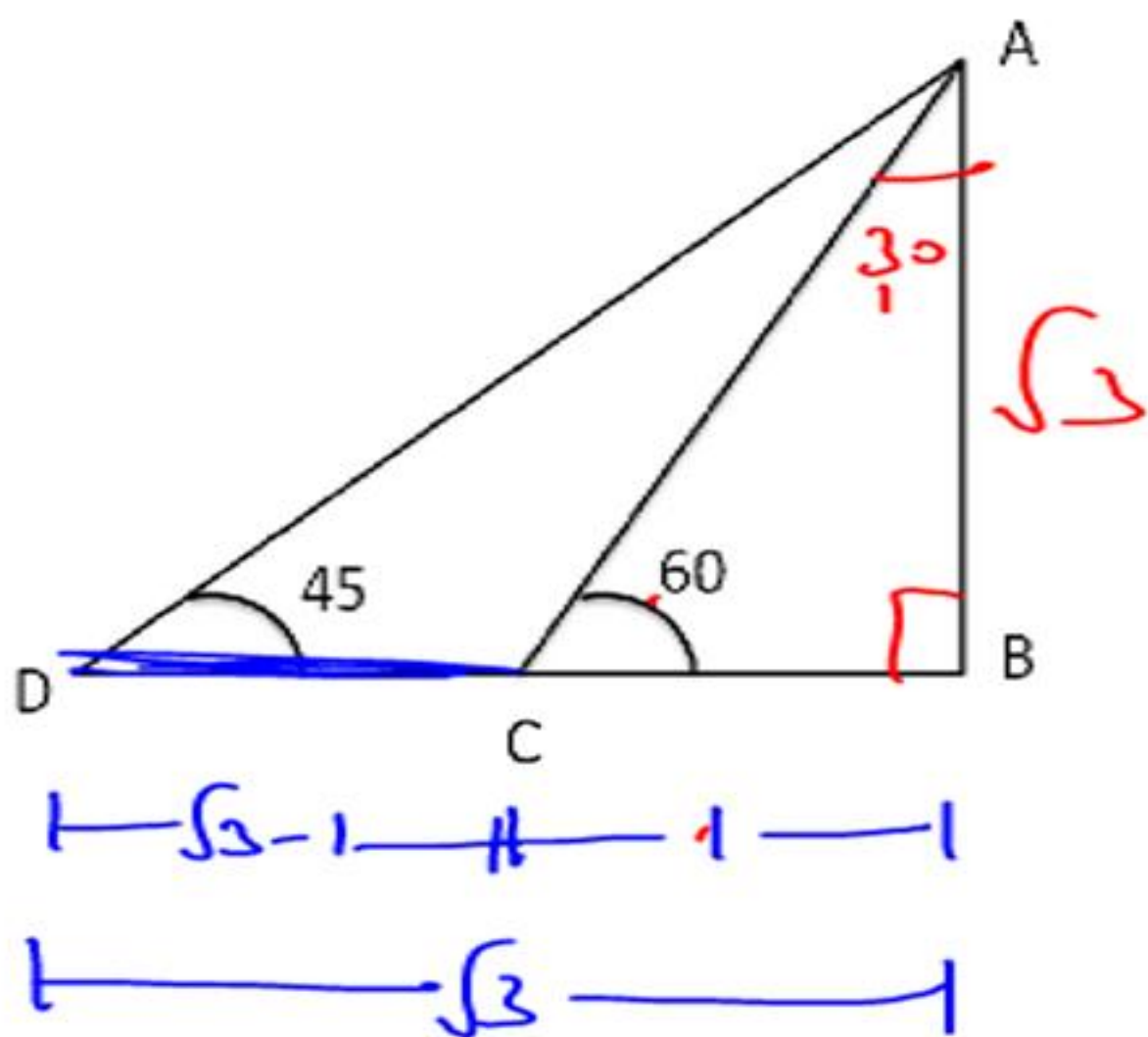
Eg. If, $DC = 50$ metre & $BC = 25$ metre then find AB .

2 \rightarrow 50m

1 \rightarrow 25m

$AB \rightarrow \underline{\underline{25\sqrt{3}}}$





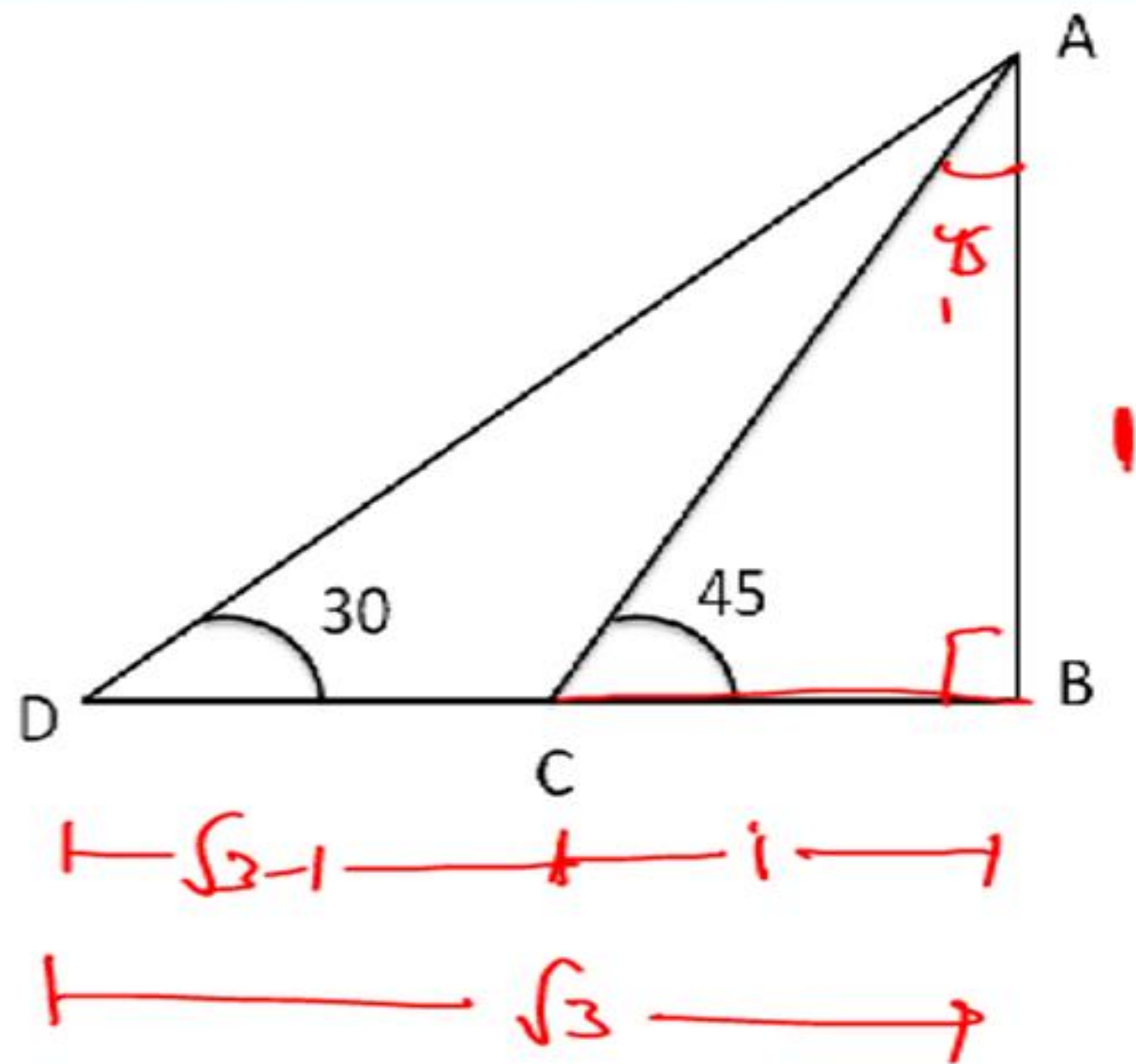
Eg. If BD = 30 metre
Find, CD & AB.

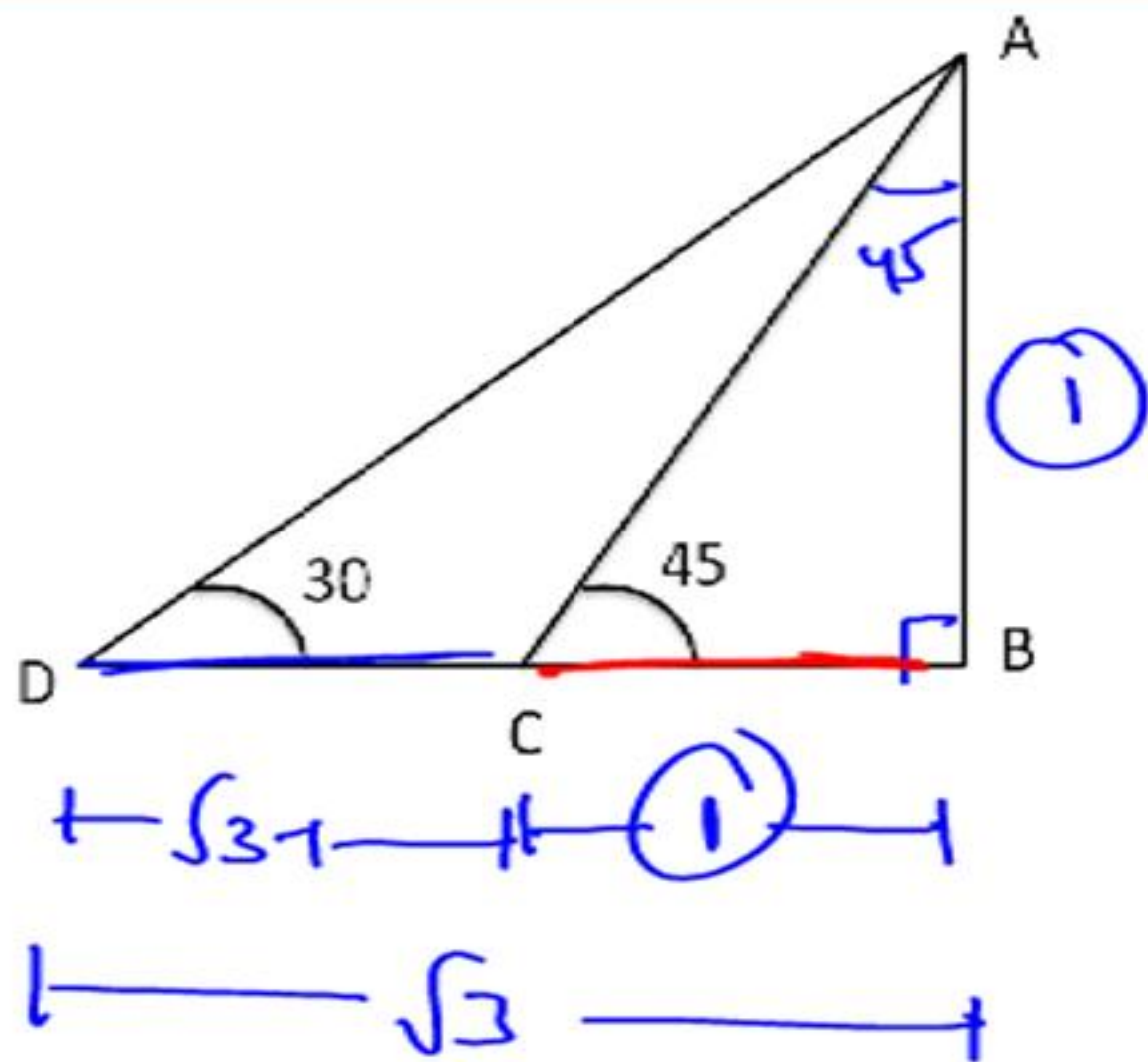
$\sqrt{3}$ units $\rightarrow 30$

$$\textcircled{1} \rightarrow \frac{30}{\sqrt{3}} = \underline{\underline{10\sqrt{3}}}$$

$$CD = (\sqrt{3}-1) \rightarrow 10\sqrt{3}(\sqrt{3}-1) \\ = \underline{\underline{30-10\sqrt{3}}}$$

$$AB = 10\sqrt{3} \cdot \sqrt{3} = \underline{\underline{30M}}$$





Eg. If, CD = 20 metre
Find, BC & AB.

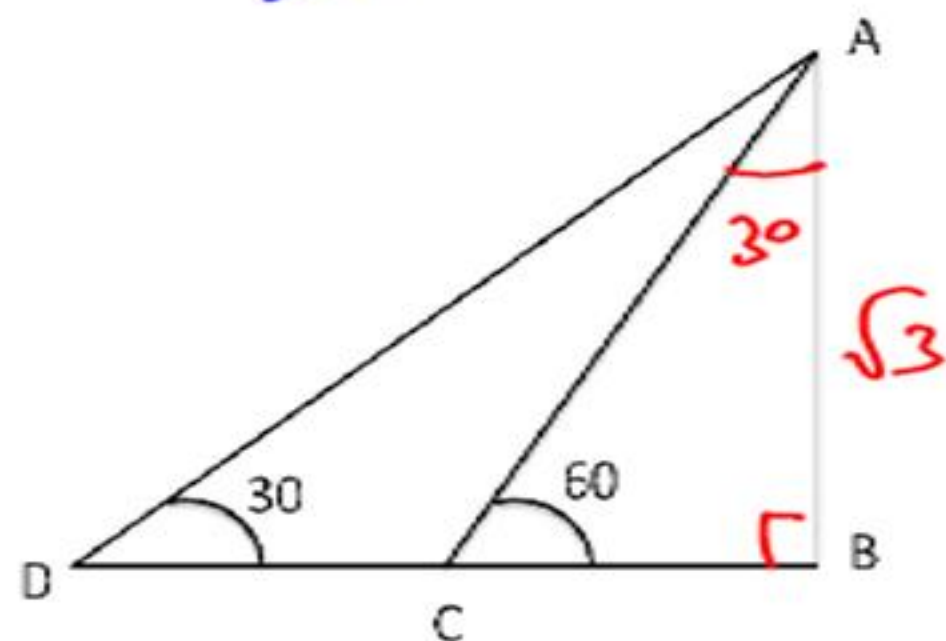
$$(\sqrt{3}-1) \text{ units} \longrightarrow 20 \text{ m}$$

$$1 \text{ unit} \longrightarrow \frac{20}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1}$$

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

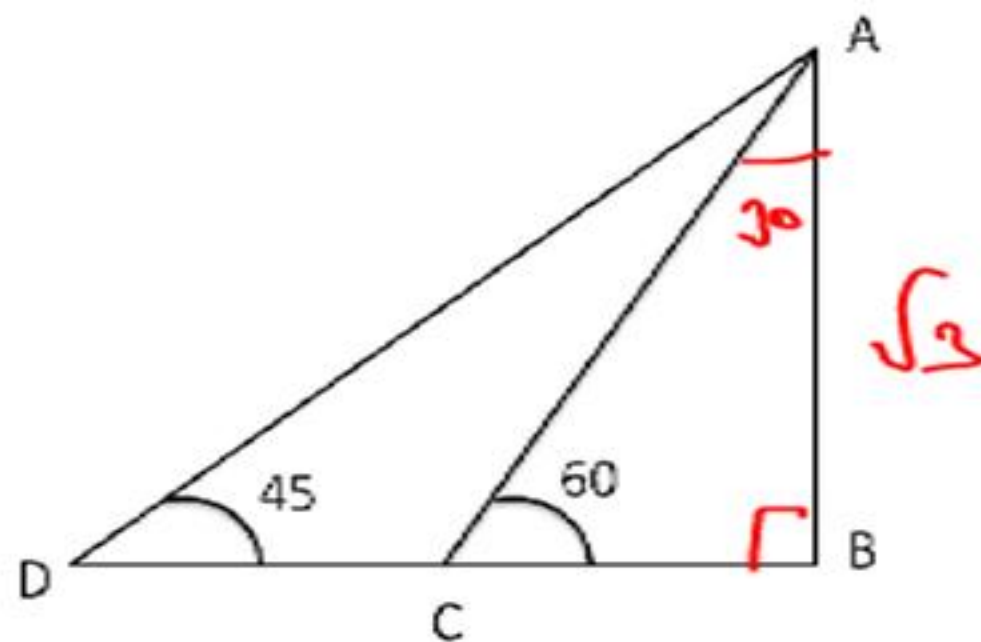
$$AB = 10(\sqrt{3}+1)$$

V. Ans



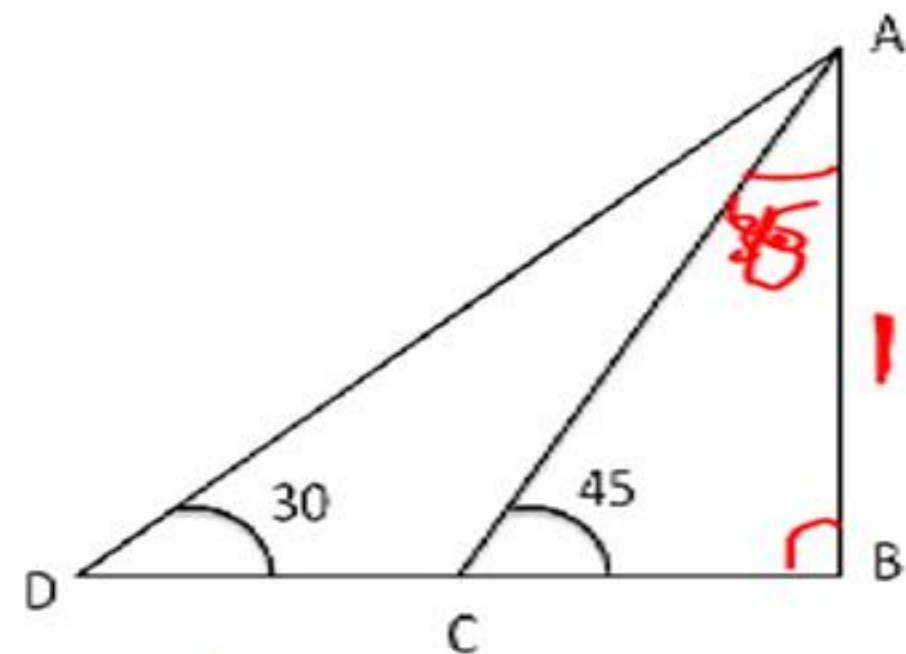
$| \text{---} 2 \text{---} | \text{---} 1 \text{---} |$

$| \text{---} 3 \text{---} |$



$| \text{---} \sqrt{3} - 1 \text{---} | \text{---} 1 \text{---} |$

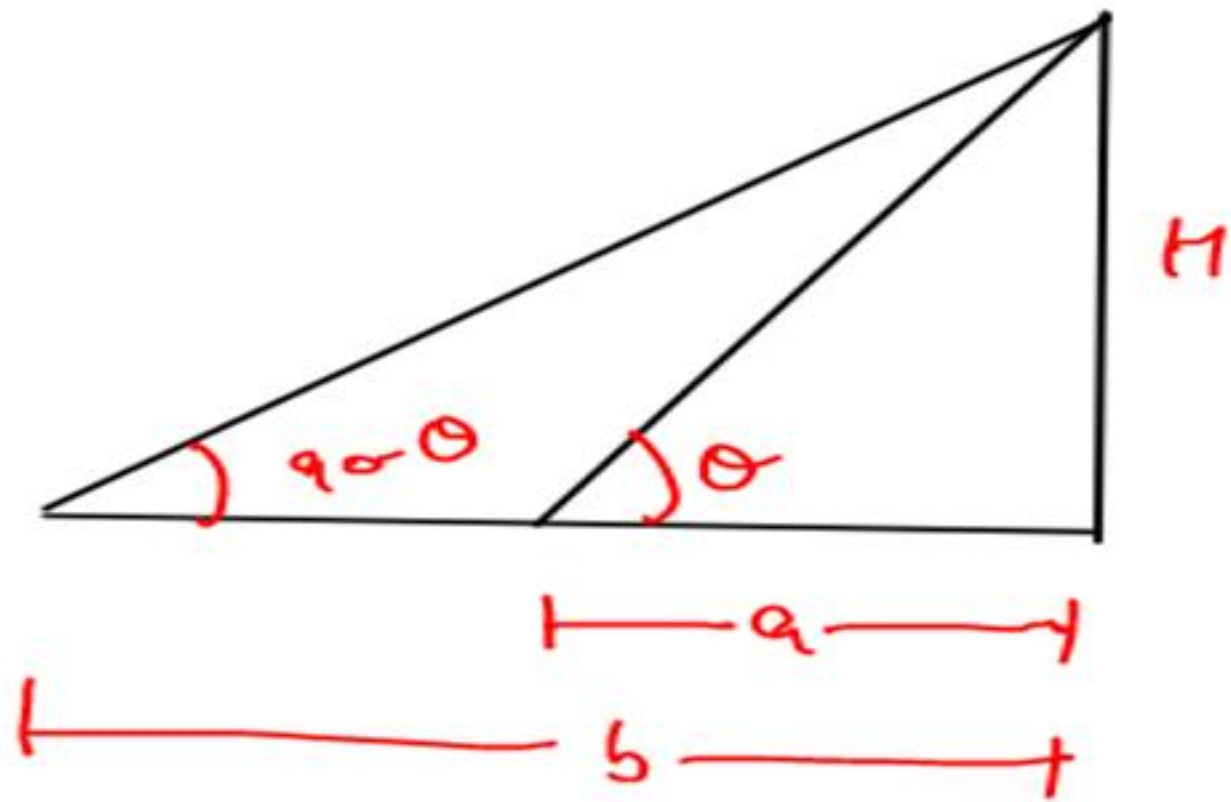
$| \text{---} \sqrt{3} \text{---} |$



$| \text{---} \sqrt{3} - 1 \text{---} | \text{---} 1 \text{---} |$

$| \text{---} \sqrt{3} \text{---} |$

Q1. The angles of elevation of the top of a tower from two points at distances a and b metres from the base and in the same straight line with it are complementary. Prove that the height of the tower is \sqrt{ab} metres.



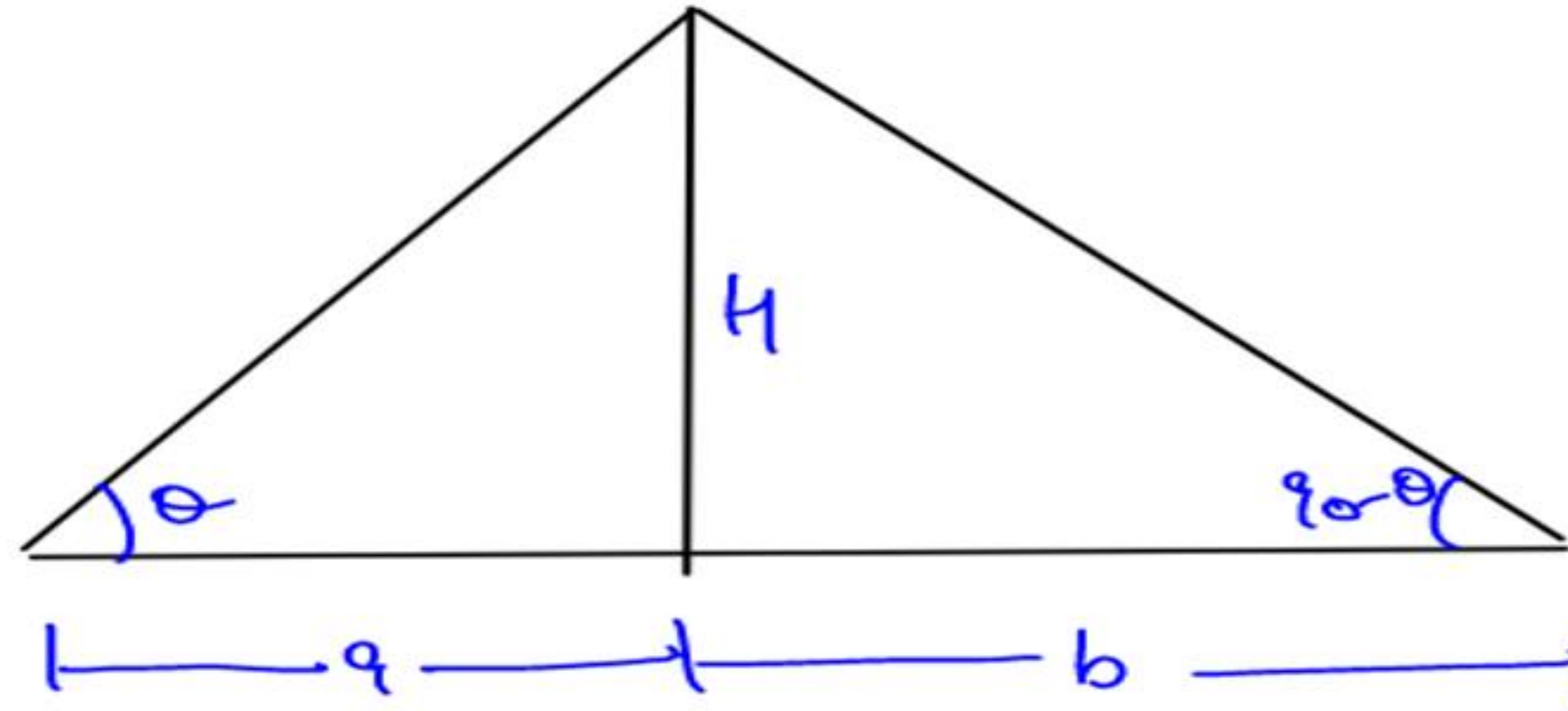
$$\tan \theta = \frac{H}{a} \quad \text{--- (1)}$$

$$\tan(90^\circ - \theta) = \frac{H}{b}$$

$$\cot \theta = \frac{H}{b} \quad \text{--- (2)}$$

$$1 = \frac{H^2}{ab}$$

$$H = \sqrt{ab}$$



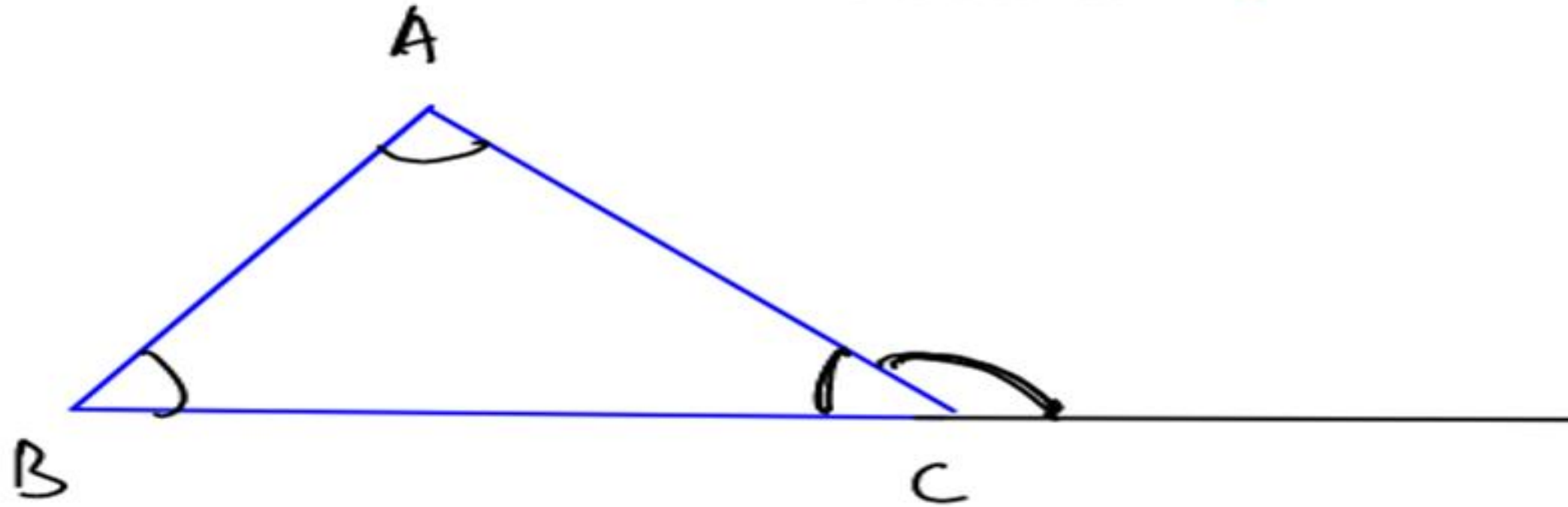
$$\tan \theta = \frac{H}{a}$$

$$\tan (90 - \theta) = \frac{H}{b}$$

$$1 = \frac{H^2}{ab}$$

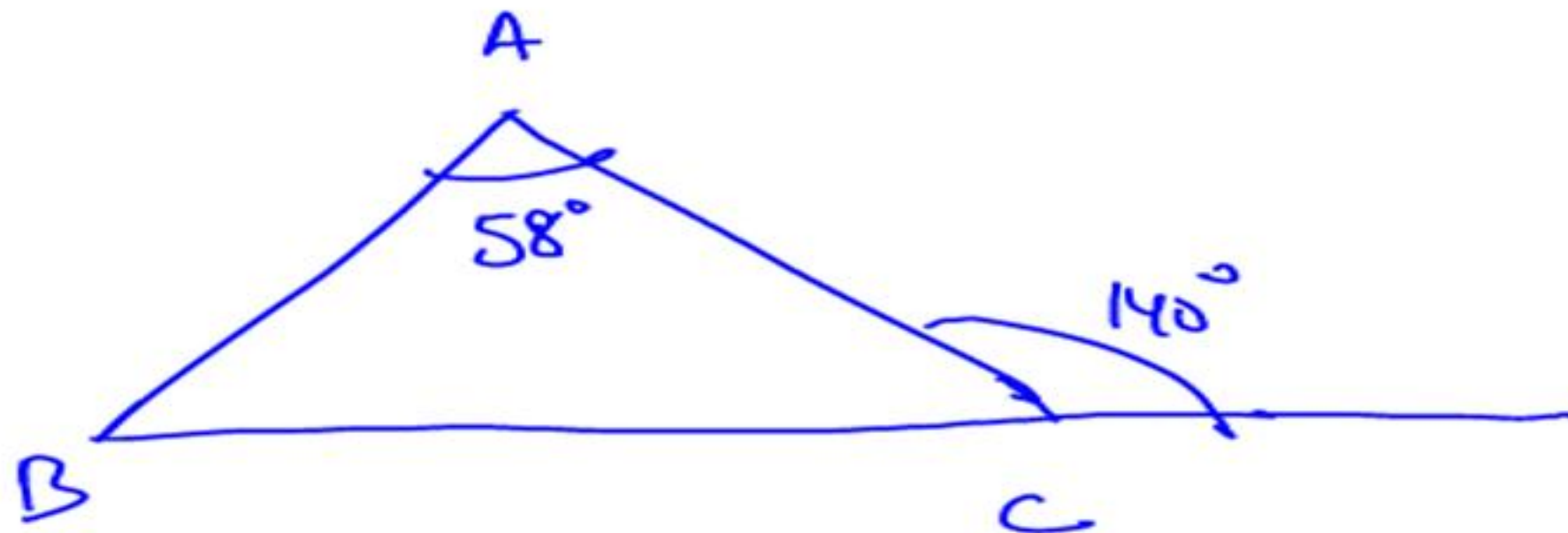
$$H = \sqrt{ab}$$

EXTERIOR ANGLE PROPERTY OF TRIANGLE



$$\text{ext } \angle C = \angle A + \angle B$$

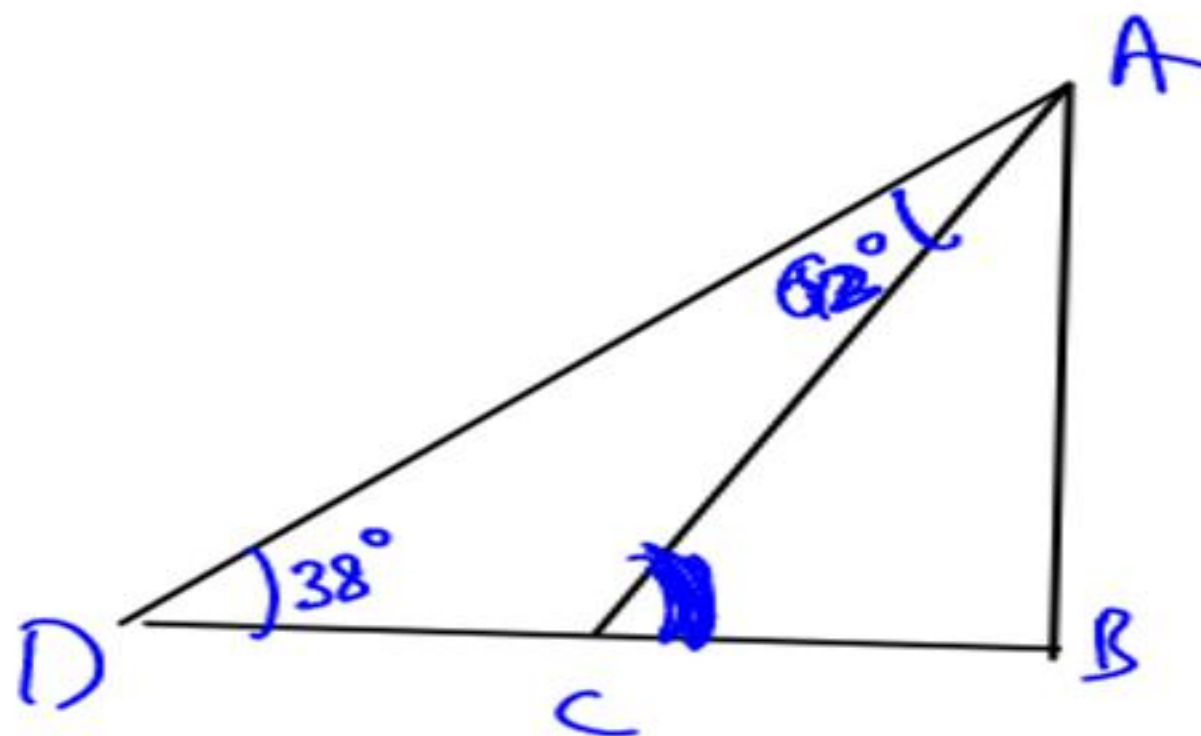
eg 1



$$\angle B = ???$$

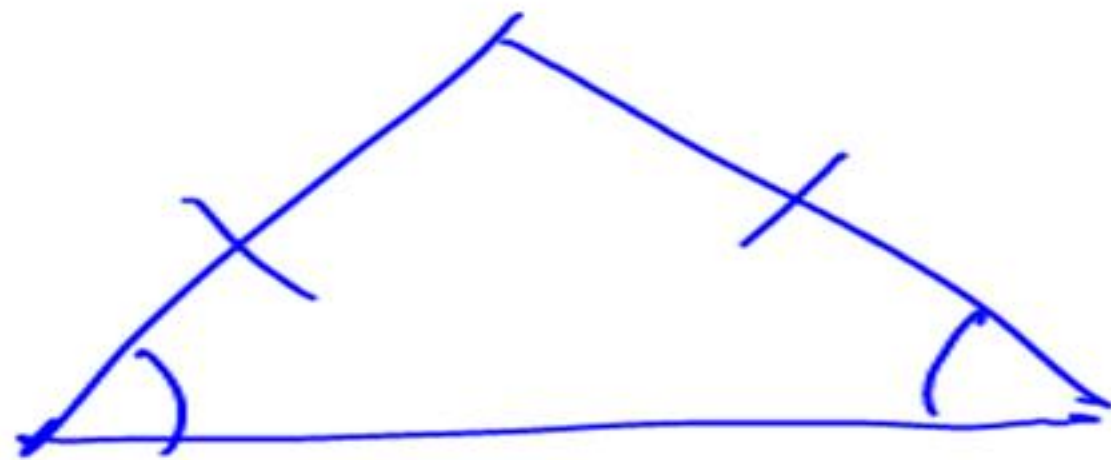
$$58 + \angle B = 140 \quad \angle B = 82^\circ$$

eg 2

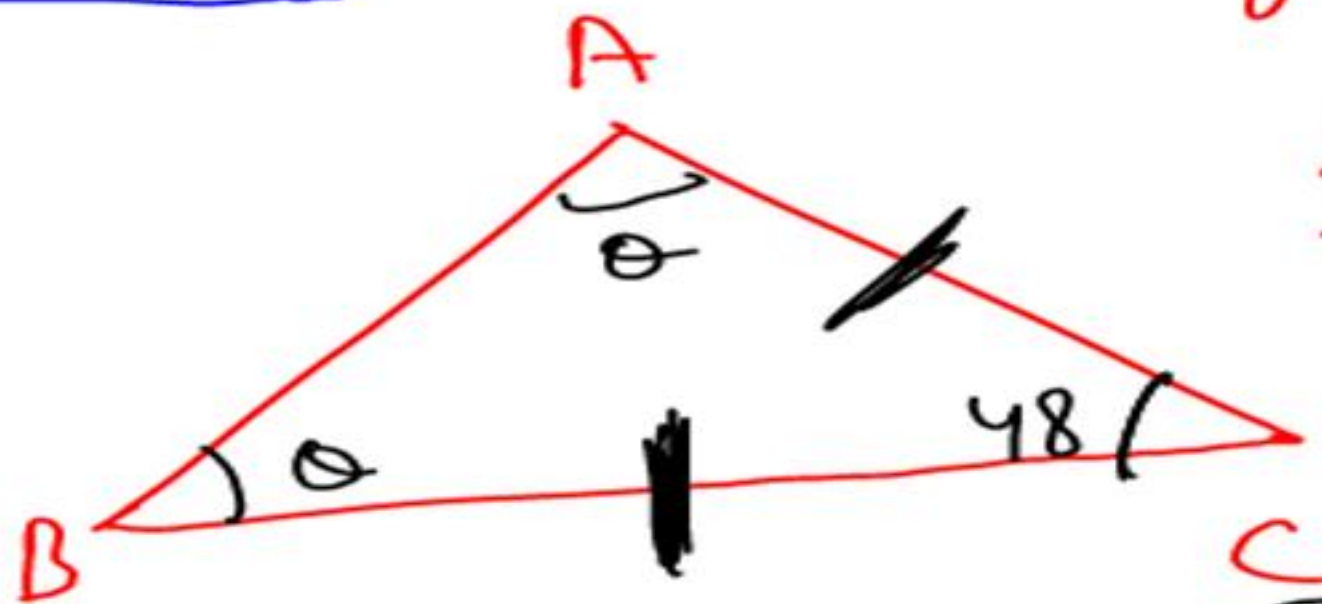


$$\begin{aligned} \angle ACB &= 62 + 38 \\ &= 100 \end{aligned}$$

* Angle opp to equal sides
are equal & vice versa



eg



$$2x + 48 = 180$$

$$\boxed{x = 66}$$

$$\text{If } \angle C = 48^\circ$$

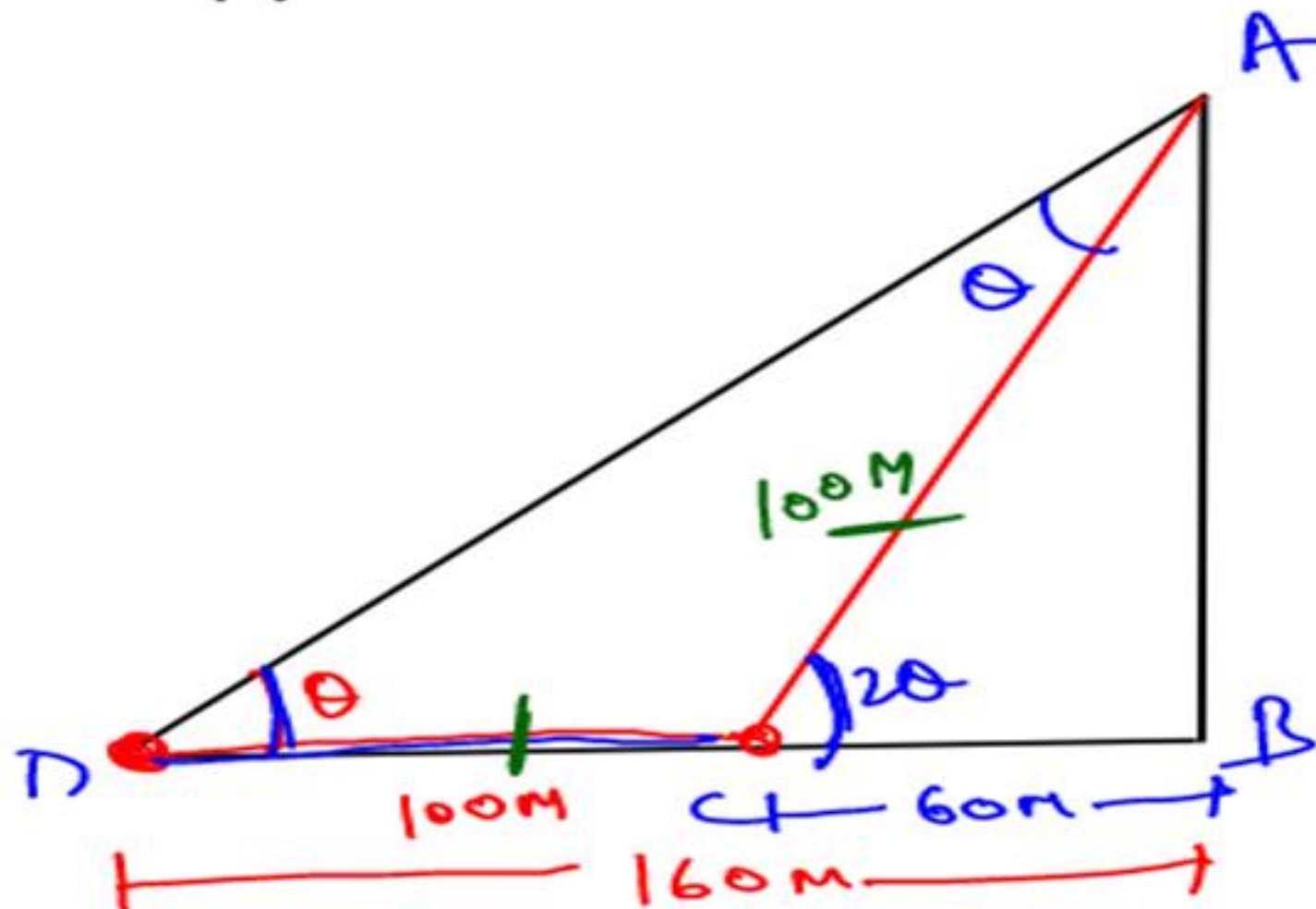
$$\underline{BC = AC}$$

$$\angle B = ??$$

Q2. A tower standing on a horizontal plane subtends a certain angle on a point 160m apart from the foot of the tower. On advancing 100m towards the tower angle becomes double of the previous angle. find the height of the tower.

- (a) 80 metre
(c) 160 metre

- (b) 100 metre
(d) 200 metre



$$(AB)^2 + 60^2 = 100^2$$

$$AB = 80\text{ m}$$

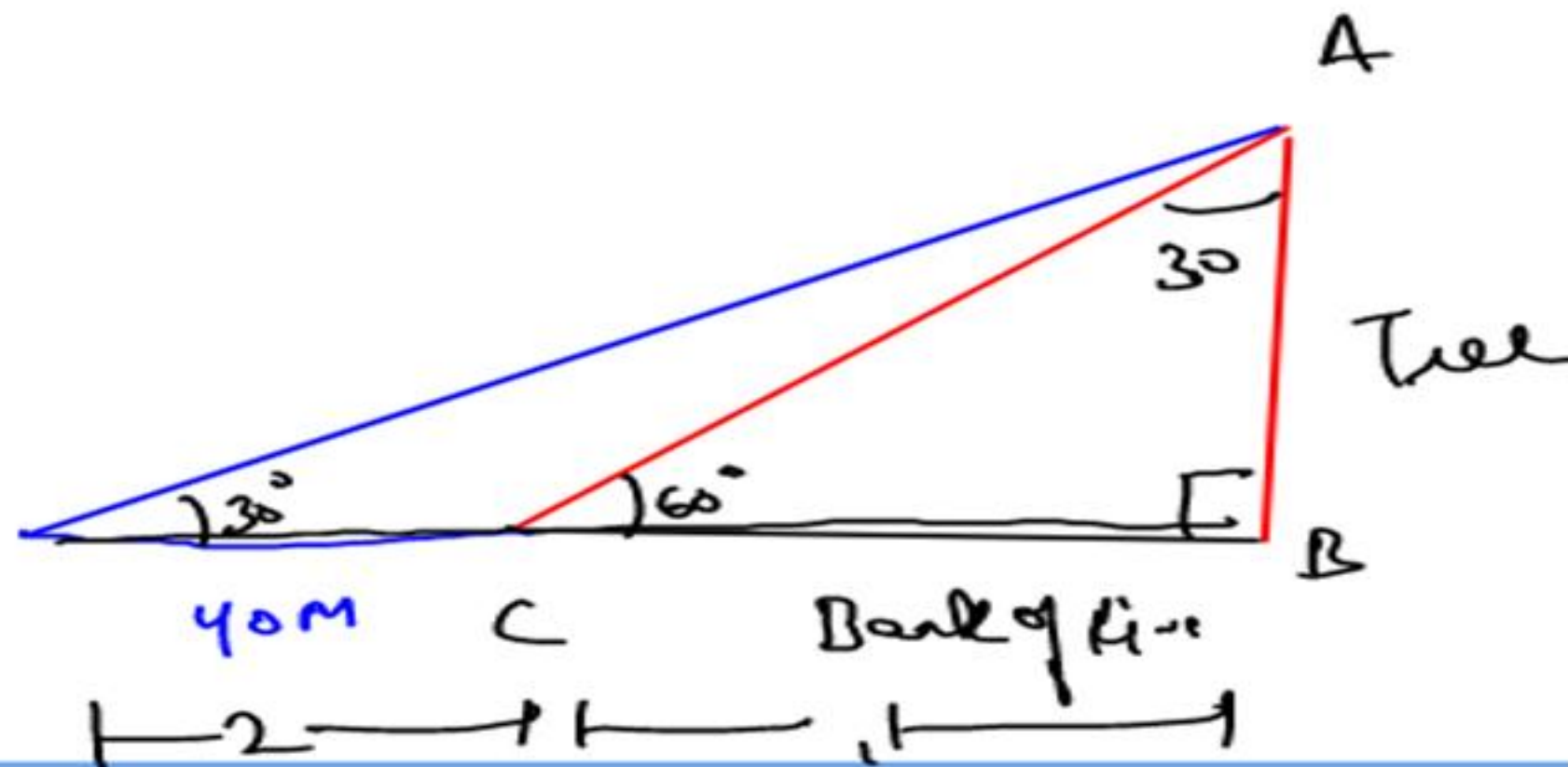
Ans. (a)

Q3. A person standing on the bank of a river observes that the angle of elevation of the top of a tree standing on the opposite bank is 60° . When he moves 40 metres 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.

- ☒ (a) ~~34.64~~ metre, 20 metre
(c) 35 metre, 10 metre

- (b) 36 metre, 20 metre
(d) 36 metre, 10 metre

90sec



$$\rightarrow 20m$$

$$20\sqrt{3} \quad 20 \times 1.732$$

Ans. (a)

Q4. The angles of elevation of the top of a building from the top and bottom of a tree are α and β respectively. If the height of the tree is h metre, then the height of the building is (in metre)-

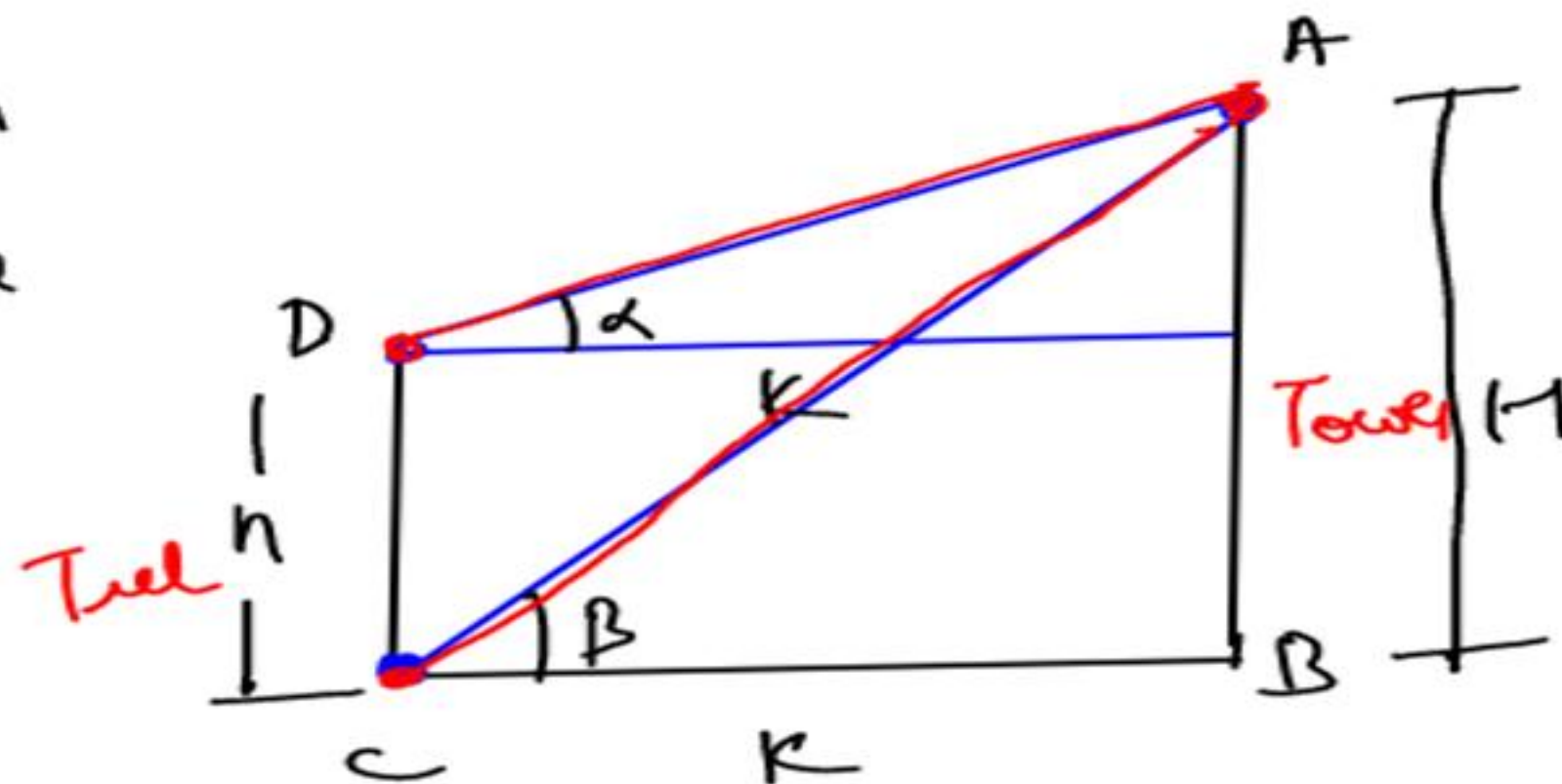
(a) $\frac{h \cot \alpha}{\cot \alpha + \cot \beta}$

(b) $\frac{h \cot \beta}{\cot \alpha + \cot \beta}$

(c) $\frac{h \cot \alpha}{\cot \alpha - \cot \beta}$

(d) $\frac{h \cot \beta}{\cot \alpha - \cot \beta}$

AB \rightarrow Tower
CD \rightarrow Tree



Qase c

$$\cot \alpha = \frac{x}{H-h} \quad (1)$$

$$\cot \beta = \frac{x}{H} \quad (2)$$

$$\frac{\cot \alpha}{\cot \beta} = \frac{H}{H-h}$$

$$H \cot \alpha - h \cot \alpha = H \cot \beta$$

$$H = \frac{h \cot \alpha}{\cot \alpha - \cot \beta}$$

Ans. (c)

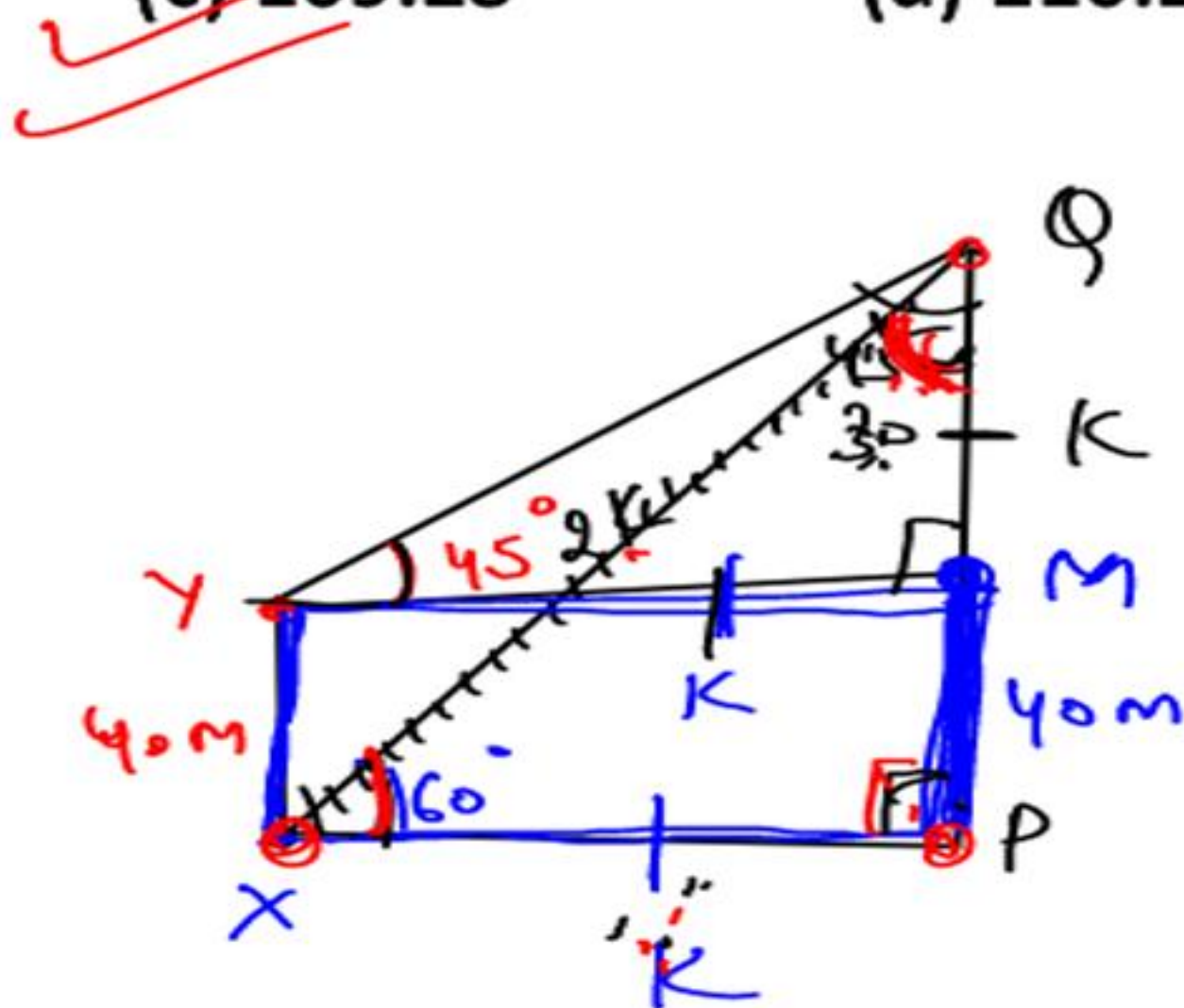
Q5. The angle of elevation of the top Q of a vertical tower PQ from a point X on the ground is 60° . At a point Y 40m vertically above X, the angle of elevation is 45° . find the distance XQ.

(a) 107.28

(b) 108.28

(c) 109.28

(d) 110.28



$$\frac{K}{K+40} = \frac{1}{\sqrt{3}}$$

$$\sqrt{3}K = K + 40$$

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

$$= 20(\sqrt{3}+1)$$

$$XQ = 40(\sqrt{3}+1) = 40(2.73)$$

Ans. (c)

$$40 \times 2.73$$

$$27.3 \times 4$$

$$\underline{109.2}$$

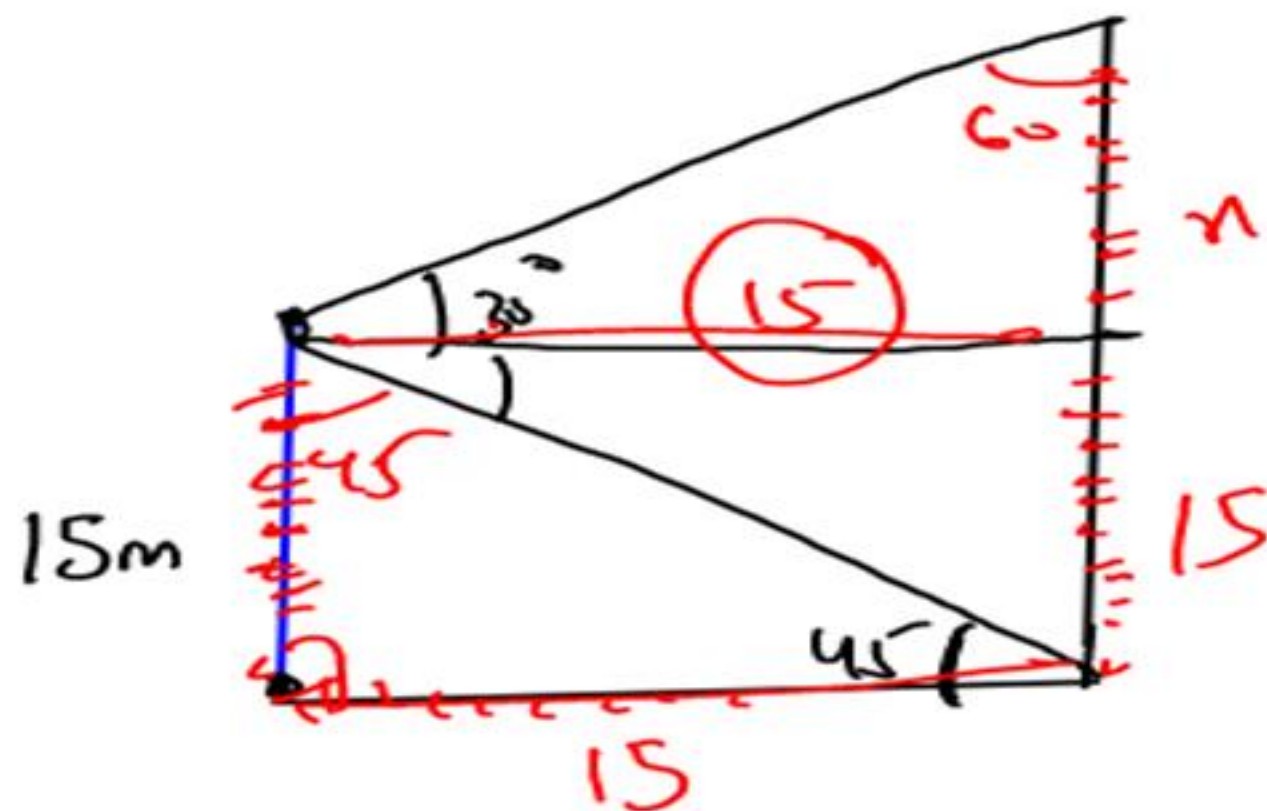
Q6. From a window 15 metres high above the ground in a street, the angles of elevation and depression of the top and the foot of another house on the opposite side of the street are 30° and 45° respectively. Find the height of the house. (Take $\sqrt{3} = 1.732$)

(a) 22 metre

(b) 24 metre

(c) 23.66 metre

(d) 25.5 metre



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

$$5\sqrt{3} + 15$$

$$5 \times 1.73 + 15$$

$$8.65 + 15$$

Ans. (c)

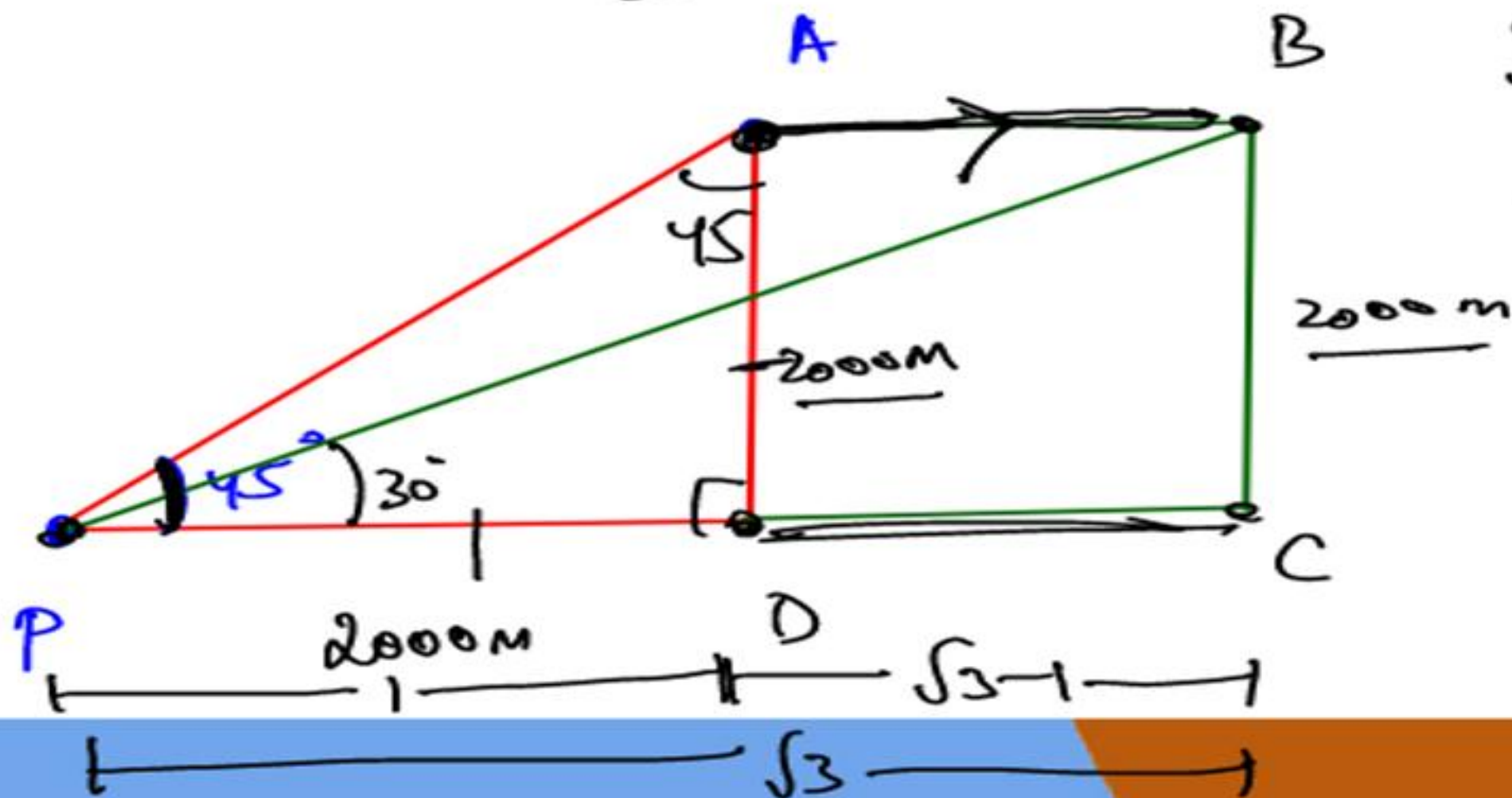
Q7. The angle of elevation of a aeroplane from a point on the ground is 45° . After a flight of 10 sec, the angle of elevation changes to 30° . If the aeroplane is flying at a height of 2000 m, find speed of aeroplane.

(a) 142.4 m/s

(c) 145.4 m/s

(b) 143.4 m/s

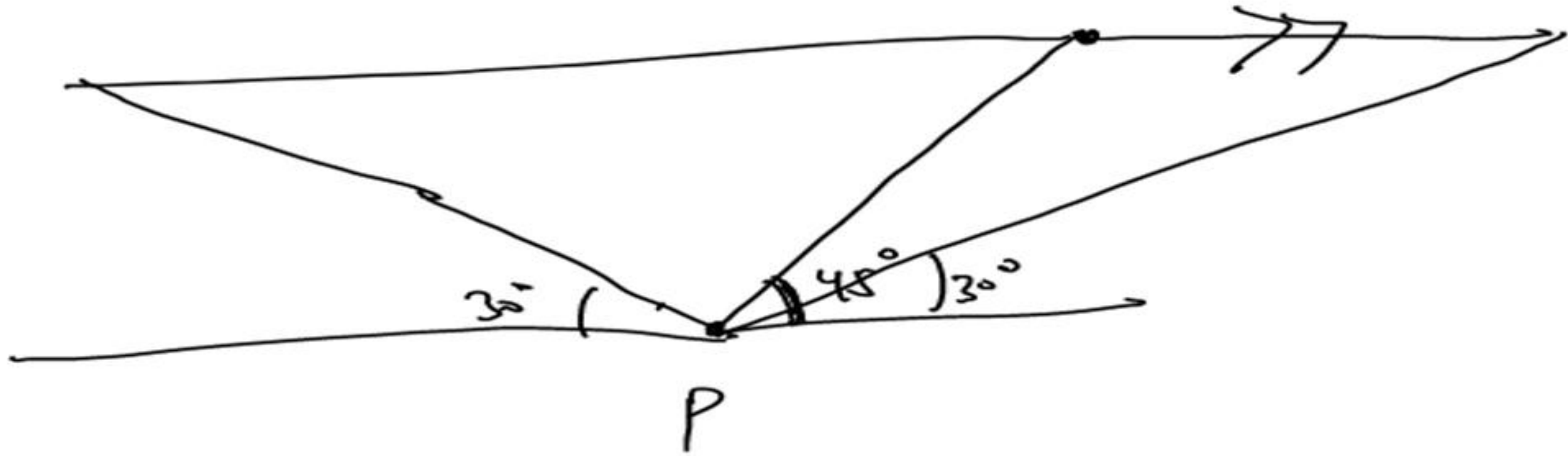
~~(d) 146.4 m/s~~



$$DC = 2000(\sqrt{3}-1)$$

$$AB = \frac{20\sqrt{3}(\sqrt{3}-1)}{17}$$

$$200(0.732)$$



why we are taking Right

Ans. (d)

Q8. A vertical tower stands on a horizontal plane and is surmounted by a vertical flag staff of height h . At a point on the plane, the angle of elevation of the bottom of the flag staff is α and that of the top of the flag staff is β . then the height of the tower is

(a) $h \tan \alpha$

(b) $\frac{h \tan \alpha}{\tan \beta - \tan \alpha}$

(c) $\frac{h \tan \alpha}{\tan \alpha - \tan \beta}$

(d) None of these

Ans. (b)



Q9. The angle of elevation of a cloud from a point 60m above a lake is 30° and the angle of depression of the reflection of cloud in the lake is 60° . Find the height of the cloud.

(a) 100 metre

(b) 120 metre

(c) 80 metre

(d) 60 metre

Ans. (b)



gradeup

Angle made by the balloon at the eye of observer = α

Angle of elevation from the centre of balloon = β

Radius of the balloon = R

**Height of the centre of balloon
from the bottom**

$$R \operatorname{cosec} \left(\frac{\alpha}{2} \right) \sin \beta$$

Q10. A round balloon of radius 10 m. subtends an angle 60° at the eye of the observer on the ground while the angle of elevation of its centre is 45° . Find the height of the centre of balloon ?

(a) $10\sqrt{2}$ metre

(b) $10\sqrt{3}$ metre

(c) 10 metre

(d) 20 metre

Ans. (b)

Q11. A round balloon of radius R subtends an angle 60° at the eye of the observer on the ground while the angle of elevation of its centre is 60° . Find the height of the centre of balloon.

(a) $\sqrt{3} R$

(b) $\sqrt{2} R$

(c) $3R$

(d) $2R$

Ans. (a)

Q12. A 1.2m tall girl spots a balloon moving with the wind in a horizontal line at a height of 88.2m from the ground. The angle of elevation of the balloon from the eyes of the girl at any instant is 60° . After some time, the angle of elevation reduces to 30° . Find the distance travelled by the balloon during the interval.

(a) $50\sqrt{3}$

(b) $52\sqrt{3}$

(c) $58\sqrt{3}$

(d) $62\sqrt{3}$

Ans. (c)

Q13. A boy is standing in the middle of a field, observes a flying bird in the north at an angle of elevation of 30° and after 2 min, he observes the same bird in the south at an angle of elevation of 60° . If the bird flies all along in a straight line at a height of $100\sqrt{3}$ m then its speed in km/h is.

(a) $10/3$ km/hr

(b) $3/5$ km/hr

(c) 10 km/hr

(d) 12 km/hr

Ans. (d)

Q14. A bird is flying at constant height from the ground with a constant speed from an observer on the ground the angle of elevation of that flying bird is 60° . when bird flies 100m away from the observer the angle change to 30° . At what distance is the bird from the observer in the second position.

(a) 173.2

(b) 273.2

(c) 373.2

(d) 473.2

Ans. (a)

Q15. A boy standing on a horizontal plane finds a bird flying at a distance of 200m. from him at an elevation of 30° . A girl standing on the roof of 20 m high building finds the angle of elevation of the same bird to be 45° . Both the boy and girl are on opposite sides of the bird. Find the distance of the bird from the girl ?

(a) 106.28

(b) 113.12

(c) 142.42

(d) 122.8

Ans. (b)



Q16. A tree 12 m high, is broken by the wind in such a way that its top touches the ground and makes an angle 60° with the ground. At what height from the bottom the tree is broken by the wind?

(a) 4.49 metre

(b) 3.36 metre

(c) 5.2 metre

(d) 5.56 metre

Ans. (d)

Q17. As the angle of elevation of the sun increases from 30° to 60° , the length of the shadow of the building gets reduced by 20m. find the height of the building.

(a) $10\sqrt{3}$ metre

(b) $5\sqrt{3}$ metre

(c) $4\sqrt{3}$ metre

(d) 5 metre

Ans. (a)

Q18. The shadow of a flag staff is four times as long as the shadow of the flag-staff when the sun rays meet the ground at an angle of 45° . find the angle between the sun rays and the ground at the time of longer shadow.

(a) $\tan^{-1}\left(\frac{1}{4}\right)$

(b) $\tan^{-1}\left(\frac{1}{2}\right)$

(c) $\tan^{-1}\left(\frac{1}{3}\right)$

(d) $\tan^{-1}\left(\frac{1}{8}\right)$

Ans. (a)

Q19. Two pillars of equal height and on either side of a road, which is 100m wide. The angles of elevation of the top of the pillars are 60° and 30° at a point on the road between the pillars. Find the height of each pillar.

(a) 43.3 metre

(b) 4.5 metre

(c) 42.8 metre

(d) 41.5 metre

Ans. (a)

Q20. A hydrogen filled balloon ascending at the rate of 18 km/ph was drifted by wind. Its angle of elevation at 10th and 15th minutes were found to be 60° and 45° respectively. The wind speed (in whole numbers) during the last five minutes approximately, is equal to

(a) 7 km/hr

(b) 11 km/hr

(c) 26 km/hr

(d) 33 km/hr

Ans. (d)



gradeup

Q21. A man standing in one corner of a square football field observes that the angle subtended by a pole in the corner just diagonally opposite to this corner is 60° . When he retreats 80m from the corner along the same straight line, he finds the angle to be 30° . The length of the field is-

(a) 20 metre

(c) $30\sqrt{2}$ metre

(b) $20\sqrt{2}$ metre

(d) $40\sqrt{2}$ metre

Ans. (b)



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Practise
topic-wise quizzes

Keep attending
live classes

