

RS Aggarwal Solutions for Class 10 Maths Chapter 14 Exercise 14: RS Aggarwal Solutions for Class 10 Maths Chapter 14 on Height and Distance, Exercise 14, provide detailed explanations and step-by-step solutions to problems involving trigonometric concepts. This chapter focuses on practical applications of trigonometry to calculate heights and distances, using angles of elevation and depression.

The solutions help students understand how to apply trigonometric ratios to real-life situations, such as finding the height of a building or the distance between two objects. These solutions are designed to enhance students problem-solving skills and prepare them for their board exams by providing clear, concise, and accurate methods to tackle various trigonometric problems.

RS Aggarwal Solutions for Class 10 Maths Chapter 14 Exercise 14 Overview

RS Aggarwal Solutions for Class 10 Maths Chapter 14 Exercise 14, prepared by subject experts from Physics Wallah provide a detailed overview of height and distance problems.

The solutions provide clear, step-by-step explanations that help students understand how to use trigonometric ratios effectively. By working through these solutions, students can strengthen their understanding of trigonometry, improve their problem-solving skills, and prepare thoroughly for their board exams.

RS Aggarwal Solutions for Class 10 Maths Chapter 14 Exercise 14 PDF

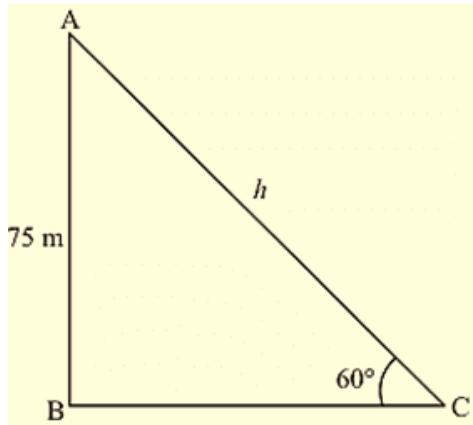
The PDF link for RS Aggarwal Solutions for Class 10 Maths Chapter 14 Exercise 14 is available below. This PDF has detailed solutions created by experts, focusing on problems related to height and distance using trigonometry. The solutions include easy-to-understand, step-by-step explanations for solving problems with angles of elevation and depression.

RS Aggarwal Solutions for Class 10 Maths Chapter 14 Exercise 14 PDF

RS Aggarwal Solutions for Class 10 Maths Chapter 14 Height And Distances Exercise 14

Q. A kite is flying at a height of 75 m from the level ground, attached to a string inclined at 60° to the horizontal. Find the length of the string, assuming that there is no slack in it. [Take $\sqrt{3}=1.732$].

Solution:



Given

Height of kite from ground ,AB=75 m

The inclination of string with ground $\theta=60^\circ$

Length of string, $L=AC$

If we represent the above data in form of the figure as shown it forms a right angle triangle $\triangle ABC$

Here,

$$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}} \Rightarrow \sin 60^\circ = \frac{AB}{AC} \Rightarrow \frac{\sqrt{3}}{2} = \frac{75}{L} \Rightarrow L = \frac{75 \times 2}{\sqrt{3}} = 150 \times \frac{1}{\sqrt{3}} = 150 \times \frac{\sqrt{3}}{3} = 50\sqrt{3} \text{ m}$$

$$L = 50 \times 1.732 = 86.60 \text{ m}$$

Q. 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, at A is 60° , then find the height of the flagstaff. [Use $\sqrt{3}=1.732$.]

Solution:



CD is the height of the flag and suppose the height of tower BC = h

Now consider right triangle ABD , we have;

$$\tan 60^\circ = \frac{BD}{AB} = \frac{BD}{120} \Rightarrow \sqrt{3} = \frac{BD}{120} \Rightarrow BD = 120\sqrt{3}$$

Also considering right triangle ABC, we have;

$$\tan 45^\circ = \frac{BC}{AB} = \frac{h}{120} \Rightarrow 1 \Rightarrow h = 120$$

$$\text{So height of flag} = BD - BC = 120\sqrt{3} - 120 = 120(3\sqrt{3} - 1) = 120 \times 0.732 = 87.84$$

Therefore height of the flag is 87.84 m.

Q. From a point on the ground 40 m away the foot of a tower, the angle of elevation of the top of the tower is 30° . The angle of elevation of the top of a water tank (on the top of the tower) is 45° . Find (i) the height of the tower, (ii) the depth of the tank.

Solution:

Let the height of the tower above the foot of the tower = h metre

Angle of elevation of the tower top from a point 40 m away from the foot of tower = 30°

$\Rightarrow h/40 = \tan 30^\circ = 1/\sqrt{3}$. Therefore height of the tower = $40 \times 1/\sqrt{3} = 40/\sqrt{3} \text{ m} = 23.094 \text{ m} \sim 23.1 \text{ m}$

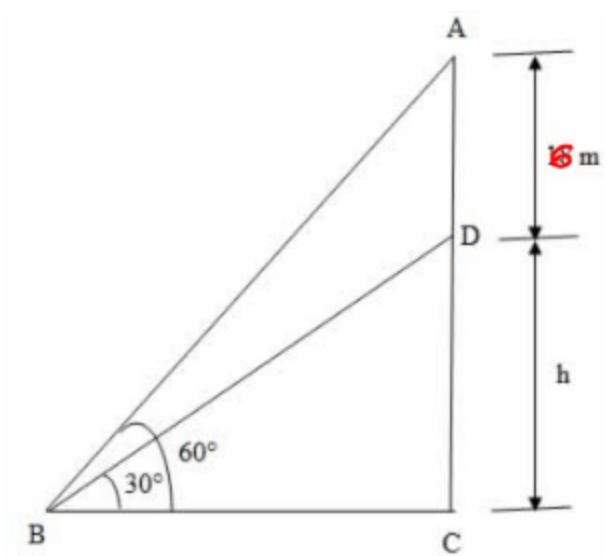
Let the combined height of the tower and the water tank atop it from the foot of the tower = H

$\Rightarrow H/40 = \tan 45^\circ$ or $H = 40 \times \tan 45^\circ = 40 \text{ m}$.

Therefore height of water tank above the top of the tower = $40 \text{ m} - 23.1 \text{ m} = 16.9 \text{ m}$.

Q. A vertical tower stands on a horizontal plane and is surmounted by a vertical flagstaff of height 6 m. At a point on the plane, the angle of elevation of the bottom of the flagstaff is 30° and that of the top of the flagstaff is 60° . Find the height of the tower. [Use $\sqrt{3}=1.732$.]

Solution:



Q. 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. [Use $\sqrt{3}=1.73$.]

Solution:

consider this situation in a triangle ABC

$$AB = AD + DB$$

where AD = height of statue

DB = height of pedestal

join DC

in triangle BDC

$$\angle BDC = \tan 45^\circ$$

let BD = x metre

$$\angle BDC = 1$$

$$x = BC$$

now in triangle ABC

$$\angle ABC = \tan 60^\circ$$

$$AD + DB = BC = \sqrt{3}$$

$$(1.46 + x)BC = \sqrt{3}$$

putting value of $\sqrt{3} = 1.73$

this gives

$$x = 1.46 \times 0.73 = 2 \text{ metres}$$

Q. The angle of elevation of the of an unfinished tower at a distance of 75 m from its base is 30° . How much higher must the tower be raised so that the angle of elevation of its top at the same point may be 60° ? [Take $\sqrt{3}=1.732$]

Solution:

$$\angle ACB = 45^\circ \text{ and } \angle DCB = 60^\circ$$

$$\angle ABC = \tan 45^\circ$$

$$\rightarrow AB = 75$$

$$\Rightarrow AB = 75 \text{ m}$$

$$\angle BDC = \tan 60^\circ$$

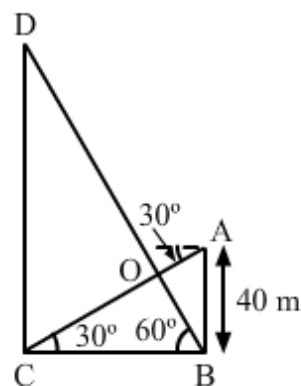
$$BD = 75\sqrt{3}$$

Q. The angle of elevation of the top of a chimney from the foot of a tower is 60° and the angle of depression of the foot of the chimney from the top of the tower is 30° . If the height of the tower is 40 metres, find the height of the chimney.

According to pollution controls norms, the minimum height of a smoke emitting chimney should be 100 metres. State if the height of the above mentioned chimney meets the pollution norms. What value is discussed in this question ?

Solution:

Let AB be the tower and CD be the chimney.
Height of the tower = AB = 40 m (Given)



In right-angled $\triangle ABC$, we have:

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

$$\Rightarrow \frac{40 \text{ m}}{BC} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow BC = 40\sqrt{3} \text{ m} \quad \dots (1)$$

In right-angled $\triangle BCD$, we have:

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

$$\Rightarrow \frac{CD}{BC} = \sqrt{3}$$

$$\Rightarrow CD = BC \times \sqrt{3}$$

$$\Rightarrow CD = 40\sqrt{3} \times \sqrt{3} \text{ m} \quad \dots [\text{Using (1)}]$$

$$\Rightarrow CD = 120 \text{ m}$$

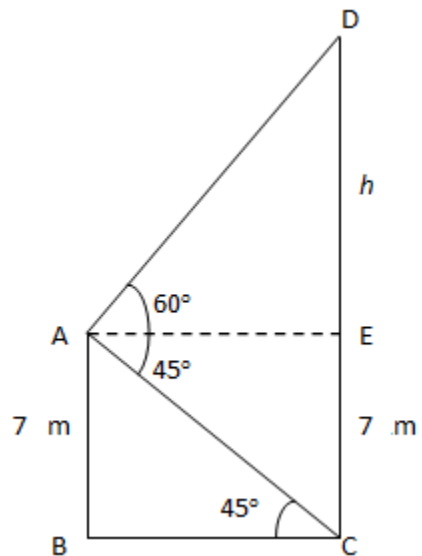
Thus, the height of the chimney is 120 m.

Hence, the height of the chimney meets the pollution norms.

In this question, the management of air pollution has been shown.

Q. From the top of a 7-metre-high building, the angle of elevation of the top of a cable tower is 60° and the angle of depression of its foot is 45° . Determine the height of the tower. [Use $\sqrt{3}=1.732$]

Solution:



Let AB be the building and CD be the tower such that $\angle EAD = 60^\circ$ and $\angle EAC = \angle ACB = 45^\circ$

Now, In triangle ABC, $\tan 45 = 1 = AB/BC$

So, $AB = AE = 7$ m

Again in triangle AED,

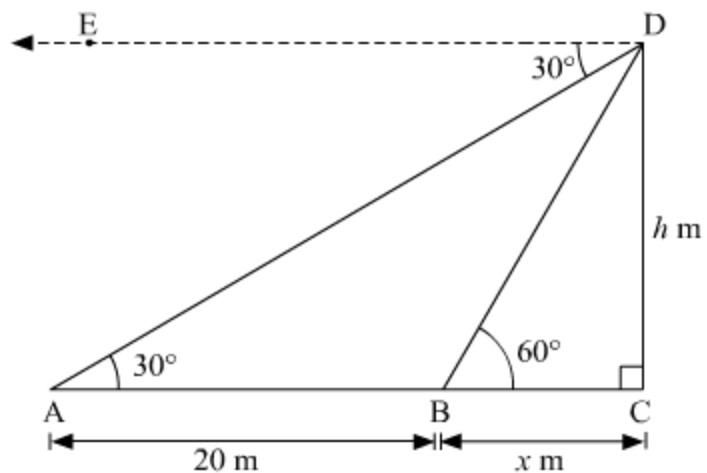
$$\tan 60 = \boxed{} = DE/AE$$

$$\text{So, } DE = AE \boxed{} = 7 \boxed{} \text{ m}$$

$$\text{Height of the cable tower} = h + 7 = 7 \boxed{} + 7 \text{ m} = 7 (1 + \boxed{}) \text{ m}$$

Q. The angle of depression from the top of a tower of a point A on the ground is 30° . On moving a distance of 20 metres from the point A towards the foot of the tower to a point B, the angle of elevation of the top of the tower from the point B is 60° . Find the height of the tower and its distance from the point A.

Solution:



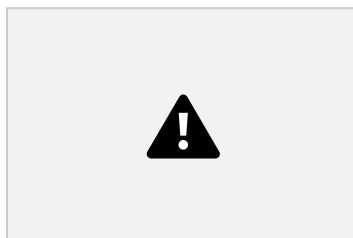
Let CD be the tower.

Suppose $BC = x$ m and $CD = h$ m.

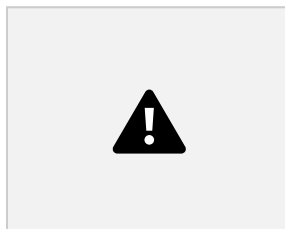
Given, $\angle ADE = 30^\circ$ and $\angle CBD = 60^\circ$.

$\angle DAC = \angle ADE = 30^\circ$ (Alternate angles)

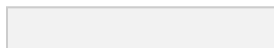
In $\triangle ACD$,



In $\triangle BCD$,



From (1) and (2), we have



$$\therefore 20 + x = 3x$$

$$\Rightarrow 2x = 20$$

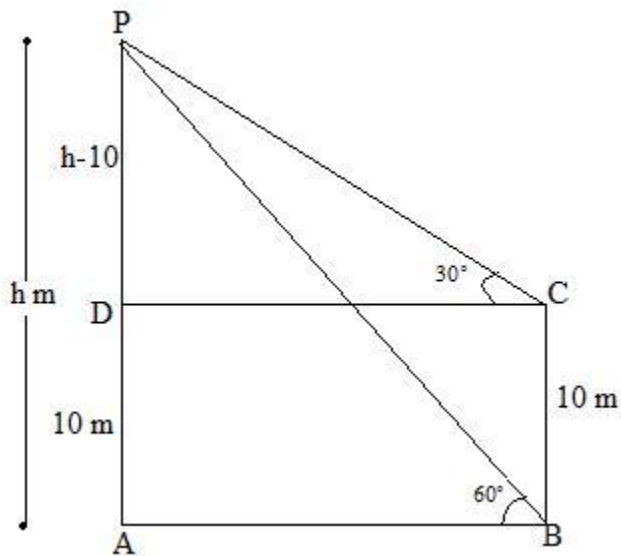
$$\Rightarrow x = 10$$

$\therefore$ Height of the tower =

Distance of tower from A = AC = $(20 + x)$ m = $(20 + 10)$ m = 30 m

Q. 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.

Solution:



Let the height of the tower be h cm.

Now, In $\triangle PAB$

$$\tan 60^\circ = \frac{PA}{AB} \Rightarrow \sqrt{3} = \frac{h}{AB} \Rightarrow AB = \frac{h}{\sqrt{3}} \text{-----(1)}$$

And, In $\triangle PCD$

$$\tan 30^\circ = \frac{PD}{CD} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h-10}{CD} \Rightarrow CD = \sqrt{3}(h-10) \text{-----(2)}$$

Since, $AB = CD$, So, equation (2) becomes,

$$AB = \sqrt{3}(h-10) \text{-----(3)}$$

Equating equation (1) and (3), we get,

$$h\sqrt{3} = \sqrt{3}(h-10) \Rightarrow h = 3(h-10) \Rightarrow 2h = 30 \Rightarrow h = 15 \text{ m}$$

Hence, the height of the tower will be 15 m

Q. A man on the deck of a ship, 16 m above water level, observes that the angles of elevation and depression respectively of the top and bottom of a cliff are 60° and 30° . Calculate the distance of the cliff from the ship and height of the cliff. [Take $\sqrt{3}=1.732$.]

Solution:

let AB be the cliff (A is highest point and B is lowest point)

and C be the top of the deck where the man is standing.

Given that angle of depression is 30°

if P is a point on AB 16m from the ground, in $\triangle CPB$

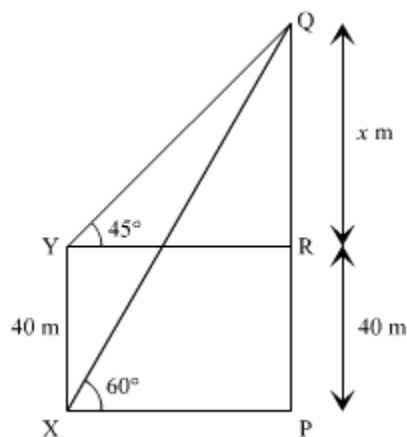
$$\angle PCB = 30^\circ \Rightarrow \tan 30^\circ = \frac{PB}{PC} \Rightarrow \frac{1}{\sqrt{3}} = \frac{PB}{PC} \Rightarrow PC = PB\sqrt{3} = 16\sqrt{3}$$

$$\triangle CPA \quad \angle PCA = 60^\circ \Rightarrow \tan 60^\circ = \frac{PA}{PC} \Rightarrow \sqrt{3} = \frac{PA}{PC} \Rightarrow PA = PC \times \sqrt{3} = 16\sqrt{3} \times \sqrt{3} = 48$$

$$\text{so height of cliff} = PA + PB = 16 + 48 = 64 \text{ m}$$

Q. The angle of elevation of the top Q of a verticle 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 tower PQ. [Take $\sqrt{3}=1.732$.]

Solution:



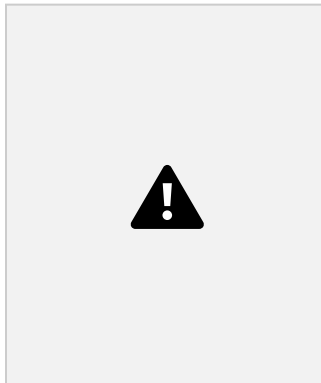
In $\triangle YRQ$, we have



$$\Rightarrow YR = x$$

$$\text{or } XP = x \text{ [As } YR = XP \text{] (1)}$$

Now, In $\triangle XPQ$, we have



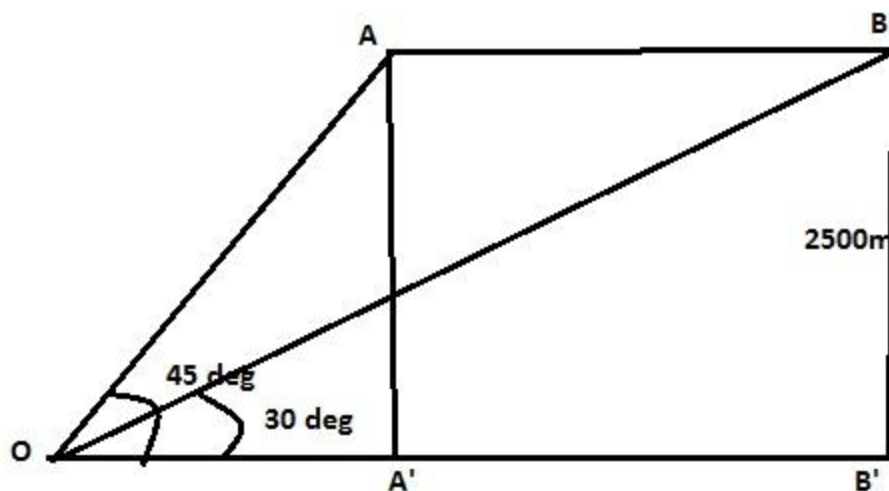
On rationalising the denominator, we get



So, height of the tower, $PQ = x + 40 = 54.64 + 40 = 94.64$ metres

Q. The angle of elevation of an aeroplane from a point on the ground is 45° . After flying for 15 seconds, the elevation changes to 30° . If the aeroplane is flying at a height of 2500 metres, find the speed of the aeroplane.

Solution:



AA' and BB' denote the height of the plane from the ground.

$$\therefore AA' = BB' = 2500 \text{ m}$$

From $\triangle OAA'$

$$\tan 45^\circ = \frac{AA'}{OA'} = \frac{2500}{OA'} \Rightarrow OA' = 2500 \text{ m}$$

From $\triangle OBB'$

$$\tan 30^\circ = \frac{BB'}{OB'} = \frac{2500}{OB'} \Rightarrow OB' = \frac{2500}{\tan 30^\circ} = 2500\sqrt{3} \text{ m}$$

Distance covered by the plane from A to B is AB or $A'B'$

$$\Rightarrow A'B' = OB' - OA'$$

$$= (2500\sqrt{3} - 2500) = 2500(\sqrt{3} - 1) = 2500(1.73 - 1) = 2500 \times 0.73 = 1825 \text{ m}$$

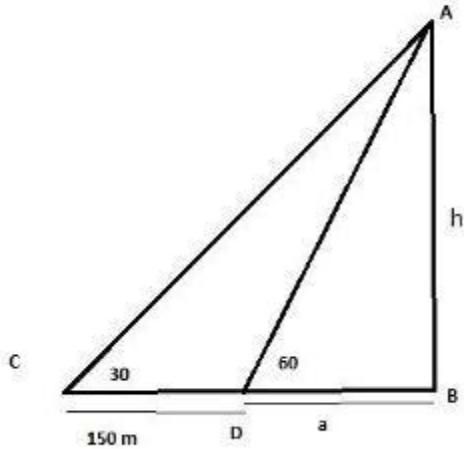
Time taken by the plane in moving from A to B = 15 seconds

Speed of the plane

$$= \frac{1825}{15} = 121.66 \text{ ms}^{-1}$$

Q. The angle of elevation of the top of a tower from a point on the same level as the foot of the tower is 30° . On advancing 150 m towards the foot of the tower, the angle of elevation becomes 60° . Show that the height of the tower is 129.9 metres. [Take $\sqrt{3} = 1.732$.]

Solution:



Use trigonometric ratios in the $\triangle ABD$,

$$\tan 60^\circ = \frac{h}{a} \Rightarrow h = a\sqrt{3} \text{ -----(1)}$$

Similarly using trigonometric ratios in the $\triangle ABC$, we get,

$$\tan 30^\circ = \frac{h}{150 + a} \Rightarrow h = (150 + a)\tan 30^\circ \text{ -----(2)}$$

Use equation(1) in equation (2),

$$a\sqrt{3} = (150 + a)\tan 30^\circ \text{ -----(3)}$$

Put the value of a in equation(1) to get the value of h ,

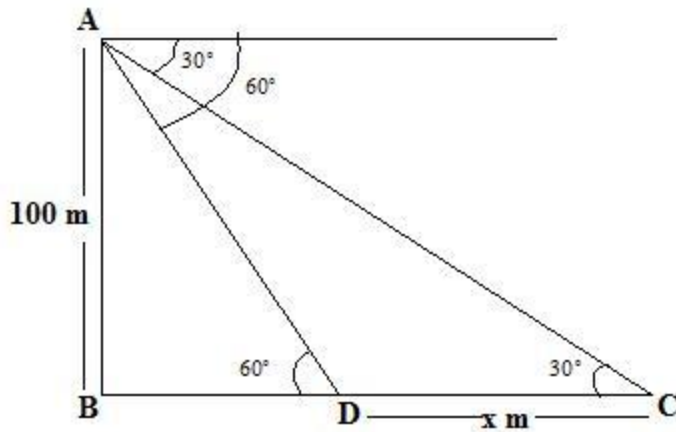
$$h = 75\sqrt{3} = 75 \times 1.73 = 129.9 \text{ m}$$

Therefore the height of the tower is 129.9 m.

Hence Proved

Q. As observed from the top of a lighthouse, 100 m 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. [Take $\sqrt{3}=1.732$.]

Solution:



Given, $AB = 100 \text{ m}$

Let x be the distance travelled by the ship during the period of observation. i.e., $CD = x \text{ m}$

In $\triangle ABD$, $\tan 60^\circ = \frac{AB}{BD} \Rightarrow \sqrt{3} = \frac{100}{BD} \Rightarrow BD = \frac{100}{\sqrt{3}}$ ----- (1)

In $\triangle ABC$, $\tan 30^\circ = \frac{AB}{BC} \Rightarrow \frac{1}{\sqrt{3}} = \frac{100}{BD + CD} \Rightarrow \frac{1}{\sqrt{3}} = \frac{100}{BD + x} \Rightarrow BD + x = 100\sqrt{3}$ ----- (2)

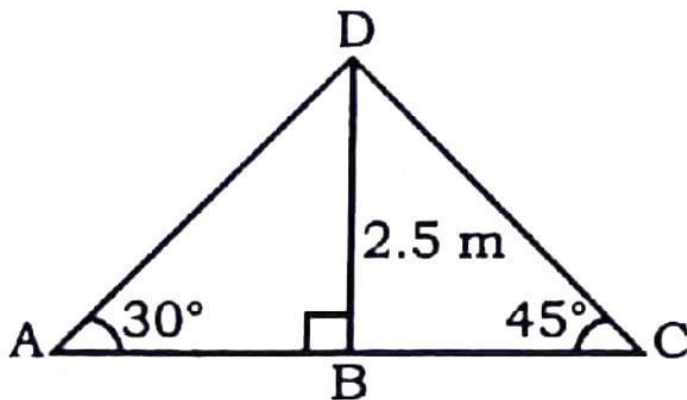
Put (1) in (2),

$$\frac{100}{\sqrt{3}} + x = 100\sqrt{3} \Rightarrow x = 100\sqrt{3} - \frac{100}{\sqrt{3}} = \frac{300 - 100}{\sqrt{3}} = \frac{200}{\sqrt{3}} = 115.47 \text{ m [Take } \sqrt{3} = 1.732 \text{]}$$

Hence, the distance travelled by the ship during the period of observation is 115.47 m

Q. From a point on a bridge across a river, the angles of depression of the banks on opposite sides of the river are 30° and 45° respectively. If the bridge is at a height of 2.5 m from the banks, find the width of the river. [Take $\sqrt{3} = 1.732$.]

Solution:



In $\triangle ABD$,

$$\tan 30^\circ = \frac{AB}{BD} \Rightarrow \frac{AB}{2.5} = \frac{1}{\sqrt{3}} \Rightarrow AB = \frac{2.5}{\sqrt{3}} = \frac{2.5 \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}} = \frac{2.5 \times 1.732}{3} = 4.33$$

In $\triangle BDC$,

$$\tan 45^\circ = \frac{BC}{CD} \Rightarrow \frac{BC}{1} = \frac{2.5}{1} \Rightarrow BC = 2.5$$

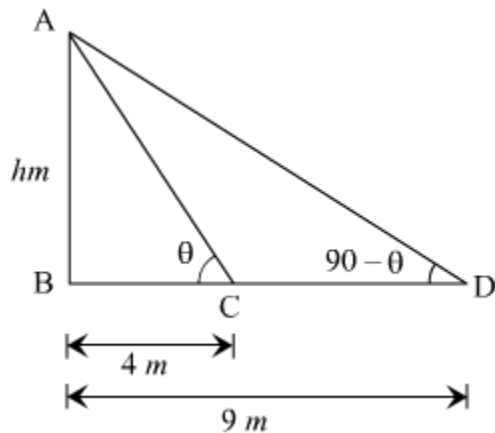
Width of river = $AB + BC$

$$= 4.33 + 2.5 = 6.83 \text{ meter}$$

Q. The angles of elevation of the top of a tower from two points at distances of 4 m and 9 m from the base of the tower and in the same straight line with it are complementary. Show that the height of the tower is 6 metres.

Solution:

The given situation can be represented as,

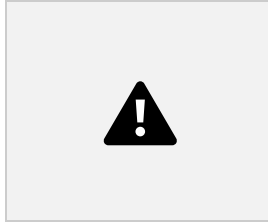


Let height of the tower be h m.

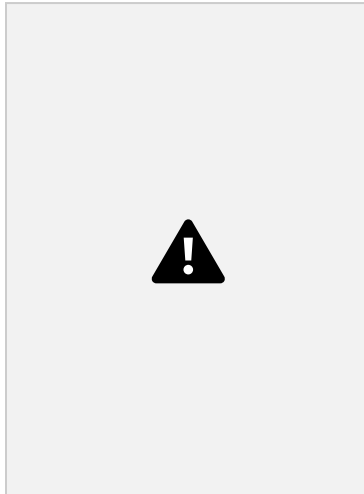
Given, the angles of elevation of the top of tower from the two points are complementary.

$$\therefore \angle ACB = \theta \text{ and } \angle ADB = 90 - \theta$$

In $\triangle ABC$,



In $\triangle ABD$,



$\therefore$ Height of the tower = $h = 4 \tan \theta = 4 \times \boxed{} = 6 \text{ m}$ (Using (1))

Thus, the height of the tower is 6 m.

Benefits of RS Aggarwal Solutions for Class 10 Maths Chapter 14 Exercise 14

- **Clear Understanding:** The solutions provide clear, step-by-step explanations, helping students understand how to solve problems related to height and distance using trigonometry.
- **Expert Guidance:** Prepared by subject experts, these solutions ensure accurate and reliable methods for solving trigonometric problems, providing trustworthy guidance for students.
- **Confidence Boost:** Regular practice with these solutions can boost students confidence in handling trigonometric problems, enhancing their overall performance in maths.
- **Step-by-Step Guidance:** Each problem is solved step-by-step, helping students follow the logic and method used to arrive at the solution, which enhances their problem-solving skills.

