Foundation

# UDAAN 2025

## MATHS

DHA : 02

## Some Applications of Trigonometry

**Q1** A tree breaks due to storm and the broken part bends so that the top of the tree touches the ground making an angle of 30° with the ground. The distance between the foot of the tree to the point where the top touches the ground is 8 m. Find the height of the tree.

**Q2** As observed from the top of a 75 m tall lighthouse, the angles of depression of two ships are 30° and 45°. If one ship is exactly behind the other on the same side of the lighthouse, find the distance between the two ships.

**Q3** The angle of elevation of the top of the building from the foot of the tower is 30° and the angle of the top of the tower from the foot of the building is 60°. If the tower is 50 m high, find the height of the building.

**Q4** From a point on a bridge across a river the angle of depression of the banks on opposite side of the river are 30° and 45° respectively. If the bridge is at the height of 30 m from the banks, find the width of the river.

**Q5** A balloon is connected to a meteorological ground station by a cable of length 215 m inclined at 60° to the horizontal. Determine the height of the balloon from the ground. Assume that there is no slack in the cable.

**Q6** The angle of elevation of the top of a building 30 m high from the foot of another building in the same plane is 60°, and also the angle of elevation of the top of the second building from the foot of the first building is 30°, then find the distance between the two buildings and height of second building

# Answer Key

**Q1** $8\sqrt{3}m$

**Q2** $75\left(\sqrt{3}-1\right)m$

**Q3** $^{50}/_{3}$ m

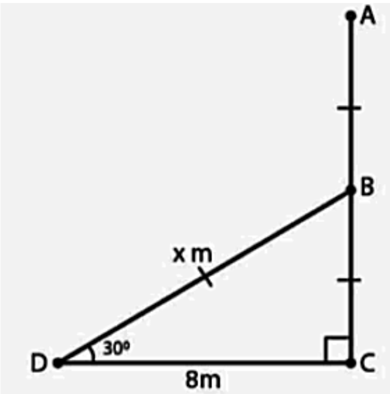
**Q4** $30\left(1+\sqrt{3}\right)m$

**Q5** 186m

**Q6** $10\sqrt{3}$m and 10m

# Hints & Solutions

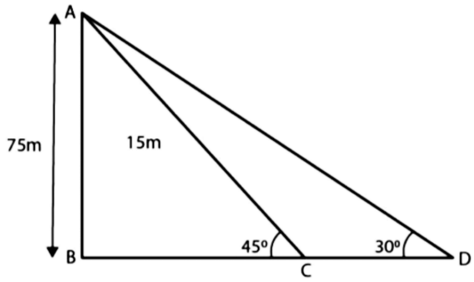
**Q1 Text Solution:**




Let the initial height of the tree be AC.
And, due to storm the tree is broken at B.
Let the bent portion of the tree be AB = x m and the remaining portion BC = h m
So, the height of the tree AC = (x + h) m
And, given DC = 8m
Now, in ABCD tan 30° = $\frac{BC}{DC}$
$\frac{1}{\sqrt{3}} = \frac{h}{8}$
$h = \frac{8}{3}$
Next, in $\Delta$BCD
cos 30°= $\frac{DC}{BD}$
$\frac{\sqrt{3}}{2} = \frac{8}{x}$
x = $\frac{16}{\sqrt{3}}$ m
So, x + h = $\frac{16}{\sqrt{3}} + \frac{8}{\sqrt{3}}$
= $\frac{24}{\sqrt{3}} = 8\sqrt{3}$
Therefore, the height of the tree is $8\sqrt{3}$ m.

**Video Solution:**

**Q2 Text Solution:**




Given; Height of the lighthouse = 75m = 'h' m = AB
Angle of depression of ship 1, $\alpha = 30°$
Angle of depression of bottom of the tall building, $\beta = 45°$
The above data is represented in form of figure as shown
Let distance between ships be 'x' m = CD
If in right angle triangle one of the included angle is $\theta$

$\tan\alpha = \frac{\mathrm{AB}}{\mathrm{DB}}$

$\tan 30^\circ = \frac{75}{\mathrm{x+BC}}$

$\mathrm{x + BC} = 75\sqrt{3} \qquad \ldots(1)$

$\tan B = \frac{\mathrm{AB}}{\mathrm{BC}}$

$\tan 45^\circ = \frac{75}{\mathrm{BC}}$

$\mathrm{BC} = 75 \qquad \ldots(2)$

Substituting (2) in (1)

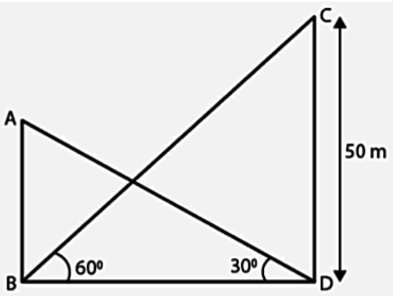
$x + 75 = 75\sqrt{3}$

$x = 75\left(\sqrt{3} - 1\right)$

Therefore, the distance between the two ships is $75\left(\sqrt{3} - 1\right)$ m

**Video Solution:**

**Q3 Text Solution:**




Let AB be the building and CD be the tower.

Given,

The angle of elevation of the top of the 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°.

Height of the tower = CD = 50 m

From the fig. we have

In $\Delta$CDB,

$\frac{CD}{BD}$ = tan 60°

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

BD = $\frac{50}{\sqrt{3}}$ .... (i)

Next in $\Delta$ABD,

$\frac{AB}{BD}$ tan 30°

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

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

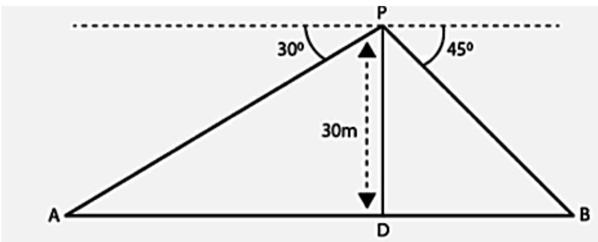
AB = $\frac{\frac{50}{\sqrt{3}}}{(\sqrt{3})}$ $\left[\text{From }\left(\text{i}\right)\right]$

AB = $\frac{50}{3}$

Therefore, the height of the building is $\frac{50}{3}$ m.

**Video Solution:**

**Q4 Text Solution:**




Given, The bridge is at a height of 30 m from the banks.

Let, A and B represent the points on the bank on opposite sides of the river. And, AB is the width of the river. P is a point on the bridge which is at the height of 30 m from the banks.

Now, from the fig, we have

AB = AD + DB

In right $\Delta$APD,

$\angle$A = 30°

So, tan 30° $\frac{PD}{AD}$

$\frac{1}{\sqrt{3}} = \frac{PD}{AD}$

AD = $\sqrt{3}$(30)

AD = 30$\sqrt{3}$ m

Next, in right $\Delta$PBD

$\angle$B = 45°

So, tan 45° $\frac{PD}{BD}$

1 = $\frac{PD}{BD}$

BD = PD

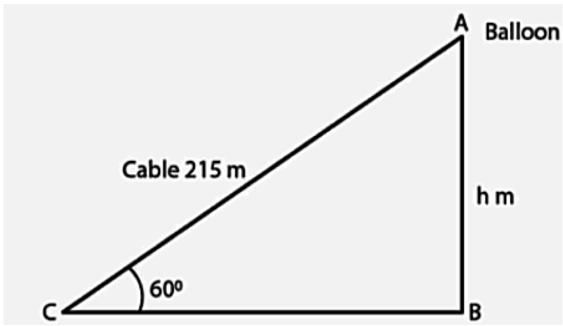
BD = 30 m

We know that, AB = AD + DB = 30$\sqrt{3}$ + 30 = 30($\sqrt{3}$ + 1)

Hence, the width of the river = 30(1 + $\sqrt{3}$)m

**Video Solution:**

**Q5 Text Solution:**




Let the height of the balloon from the ground = h m

Given, the length of the cable = 215 m and the inclination of the cable is 60°.

In $\Delta$ABC

$\sin 60° = \frac{AB}{AC}$

$\frac{\sqrt{3}}{2} = \frac{h}{215}$

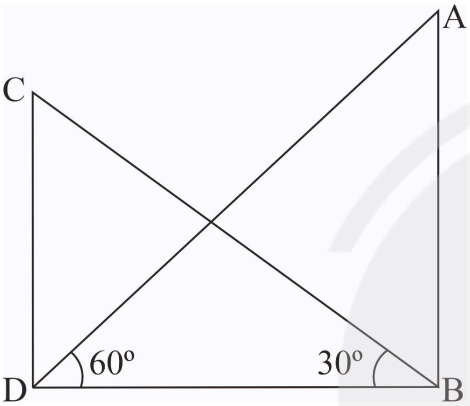
h = $\frac{215\sqrt{3}}{2}$ = 185.9

Hence, the height of the balloon from the ground is 186m (approx).

**Video Solution:**

**Q6 Text Solution:**

Let AB and CD be the buildings




$\tan 60° = \frac{30}{x}$

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

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

x = $10\sqrt{3}$m

In triangle BDC

tan 30° = CD/BD

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

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

CD = 10m

**Video Solution:**

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