

Some Applications of Trigonometry



TRY YOURSELF

SOLUTIONS

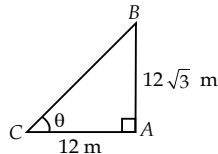
1. Let AB be the building of height $12\sqrt{3}$ m and AC is the shadow of AB of length 12 m.

Let $\angle ACB = \theta$

Now, in right $\triangle ABC$,

$$\tan \theta = \frac{AB}{AC} = \frac{12\sqrt{3}}{12}$$

$$\Rightarrow \tan \theta = \sqrt{3} = \tan 60^\circ \Rightarrow \theta = 60^\circ$$

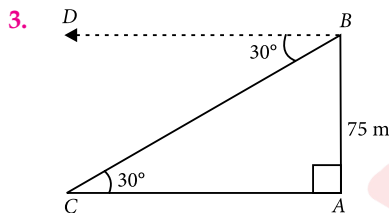
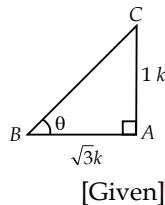


2. Let AC be the height of the tower, AB be the length of its shadow and θ be the angle of elevation of the sun.

In right $\triangle ABC$, $\tan \theta = \frac{AC}{AB} = \frac{1k}{\sqrt{3}k} = \frac{1}{\sqrt{3}}$

$$\Rightarrow \tan \theta = \tan 30^\circ \Rightarrow \theta = 30^\circ$$

Hence, angle of elevation of the sun is 30° .



Let AB be the tower of height 75 m and C is the position of car.

In right $\triangle ABC$, $\cot 30^\circ = \frac{AC}{AB}$

$$\Rightarrow AC = AB \cot 30^\circ = 75 \times \sqrt{3} = 75\sqrt{3} \text{ m}$$

Thus, the distance of the car from the base of the tower is $75\sqrt{3}$ m.

4. Let AB be the lamp-post and CD be the 1.6 m tall girl. Here, $ED = 4.8$ m is the shadow of CD .

Let $\angle AEB = \angle DEC = \theta$

In right $\triangle EDC$,

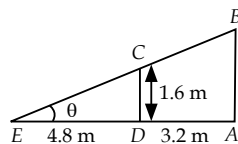
$$\tan \theta = \frac{CD}{ED} = \frac{1.6}{4.8} = \frac{1}{3} \quad \dots (i)$$

In right $\triangle ABE$,

$$\tan \theta = \frac{AB}{AE} = \frac{AB}{4.8 + 3.2} = \frac{AB}{8} \quad \dots (ii)$$

From (i) and (ii), $\frac{AB}{8} = \frac{1}{3} \Rightarrow AB = \frac{8}{3}$ m

Hence, the height of lamp post is $\frac{8}{3}$ m.



5. Let AD be the tree of height 18 m. B and C are the foot of the poles on opposite side of the river BC .

In right $\triangle ADB$,

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

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{18}{BD} \Rightarrow BD = 18\sqrt{3} \text{ m}$$

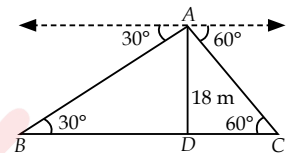
In right $\triangle ADC$,

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

$$\Rightarrow \sqrt{3} = \frac{18}{DC} \Rightarrow DC = \frac{18}{\sqrt{3}} = 6\sqrt{3} \text{ m}$$

Now, width of the river, $BC = BD + DC$

$$= 18\sqrt{3} + 6\sqrt{3} = 24\sqrt{3} \text{ m}$$



6. Let AB be the lighthouse of height h m and C and D are the positions of ship.

In right $\triangle ABC$,

$$\tan 45^\circ = \frac{AB}{AC} \Rightarrow 1 = \frac{AB}{100}$$

$$\Rightarrow AB = 100$$

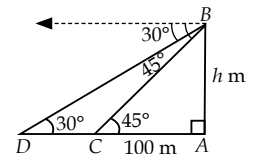
So, height of the lighthouse is 100 m.

Now, in right $\triangle ABD$,

$$\tan 30^\circ = \frac{AB}{AD} \Rightarrow \frac{1}{\sqrt{3}} = \frac{100}{100 + CD}$$

$$\Rightarrow 100 + CD = 100\sqrt{3}$$

$$\Rightarrow CD = 100(\sqrt{3} - 1) = 73.2 \text{ m}$$



7. In the figure, DC represents the statue and BC represents the pedestal.

Now, in right $\triangle ABC$,

$$\frac{AB}{BC} = \cot 45^\circ = 1$$

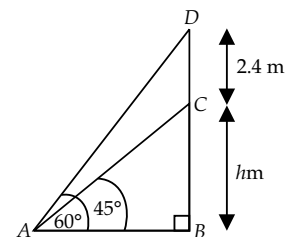
$$\Rightarrow \frac{AB}{h} = 1 \Rightarrow AB = h \text{ metres}$$

Now in right $\triangle ABD$,

$$\frac{BD}{AB} = \tan 60^\circ \Rightarrow \frac{h + 2.4}{h} = \sqrt{3}$$

$$\Rightarrow h + 2.4 = \sqrt{3}h \Rightarrow h(\sqrt{3} - 1) = 2.4$$

$$\Rightarrow h = \frac{2.4}{\sqrt{3} - 1} = \frac{2.4}{\sqrt{3} - 1} \times \frac{\sqrt{3} + 1}{\sqrt{3} + 1}$$



$$\Rightarrow h = \frac{2.4(\sqrt{3}+1)}{2} = 1.2(\sqrt{3}+1)$$

Thus, the height of the pedestal is $1.2(\sqrt{3}+1)$ m.

8. Let AB and CD

be two poles of equal height, h m.

Then $AB = CD = h$ m

Let $AP = x$ m

$\therefore CP = (60 - x)$ m

Now, in right $\triangle APB$,

$$\frac{AB}{AP} = \tan 60^\circ$$

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

Again, in right $\triangle CPD$,

$$\frac{CD}{CP} = \tan 30^\circ$$

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

From (i) and (ii), we get

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

$$\Rightarrow 3x = 60 - x \Rightarrow 4x = 60 \Rightarrow x = 15$$

$$\therefore CP = 60 - x = 60 - 15 = 45 \text{ m}$$

Now, from (i), we have

$$h = 15 \times \sqrt{3} = 15 \times 1.732 = 25.98$$

Thus, the required point is 15 m away from the first pole and 45 m away from the second pole and height of each pole is 25.98 m.

9. In the figure, let AB be the building.

$$\therefore AB = 11 \text{ m}$$

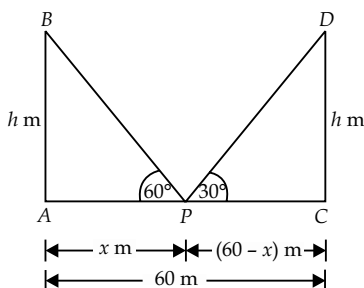
Let CD be the cable tower.

\therefore In right $\triangle ADE$,

$$\frac{DE}{EA} = \tan 60^\circ \Rightarrow \frac{h}{x} = \sqrt{3}$$

$$\Rightarrow h = x\sqrt{3} \quad \dots(i)$$

Again, in right $\triangle ABC$,



...(i)

...(ii)

$$\frac{AB}{BC} = \tan 45^\circ$$

$$\Rightarrow \frac{11}{x} = 1 \Rightarrow x = 11$$

... (ii)

From (i) and (ii), we get $h = 11\sqrt{3} = DE$

$$\therefore CD = CE + ED = 11 + 11\sqrt{3} = 11(1 + \sqrt{3}) \text{ m}$$

$$= 11(1 + 1.732) \text{ m} = 11(2.732) \text{ m} = 30.052 \text{ m}$$

Hence, height of cable tower is 30.052 m.

10. Let AX and BY are the two legs at an angle of 60° to the ground.

AR and BS are two perpendiculars on base XY .

Now, in right $\triangle AXR$,

$$\sin 60^\circ = \frac{AR}{AX}$$

$$\Rightarrow \frac{\sqrt{3}}{2} = \frac{1.2}{AX}$$

$$\Rightarrow AX = \frac{2 \times 1.2}{\sqrt{3}} = \frac{2.4}{\sqrt{3}} = \frac{2.4}{1.732} = 1.4 \text{ m (approx.)}$$

Similarly, $BY = 1.4$ m

Hence, length of each leg is 1.4 m.

11. Let C and B be the positions of Mukesh (on the roof) and Ramesh respectively. Both the kites meet at point A .

Here, $AB = 240$ m, $CD = 30$ m,

$\angle ABD = 30^\circ$ and $\angle ACO = 45^\circ$

In $\triangle AEB$,

$$\sin 30^\circ = \frac{AE}{AB}$$

$$\Rightarrow \frac{1}{2} = \frac{AE}{240}$$

$$\Rightarrow AE = \frac{240}{2} = 120 \text{ m}$$

Now, $AO = AE - OE = AE - CD = (120 - 30) \text{ m} = 90 \text{ m}$

In $\triangle AOC$,

$$\sin 45^\circ = \frac{AO}{AC} \Rightarrow \frac{1}{\sqrt{2}} = \frac{90}{AC} \Rightarrow AC = 90\sqrt{2}$$

$$= 90 \times 1.414 = 127.26 \text{ m}$$

Hence, Mukesh must have length of string as 127.26 m.

