NCERT Solutions for Class 10 Maths Chapter 9 - Some Applications of Trigonometry

Solution 1

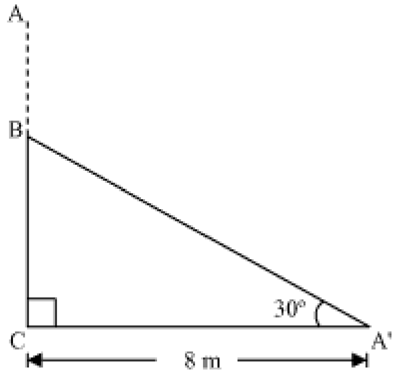
In the figure, AB is the pole.

In ΔABC,

$$\frac{AB}{AC} = \sin 30^\circ$$
$$\frac{AB}{20} = \frac{1}{2}$$
$$AB = 10$$

Thus, the height of the pole is 10 m.

Solution 2



Let AC be the original tree and A'B be the broken part which makes an angle of 30° with the ground.

In $\Delta A'BC$,

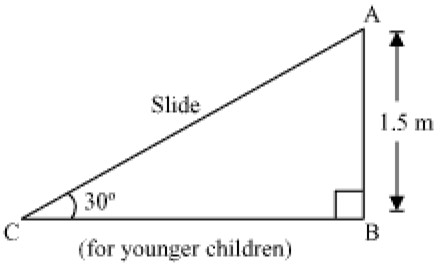
$$\frac{BC}{A'C} = \tan 30^\circ$$
$$\frac{BC}{8} = \frac{1}{\sqrt{3}}$$
$$BC = \frac{8}{\sqrt{3}}$$
$$\frac{A'C}{A'B} = \cos 30^\circ$$
$$\frac{8}{A'B} = \frac{\sqrt{3}}{2}$$
$$A'B = \frac{16}{\sqrt{3}}$$

Height of tree $= A'B + BC = \frac{16}{\sqrt{3}} + \frac{8}{\sqrt{3}} = \frac{24}{\sqrt{3}} = 8\sqrt{3}$ m

Hence, the height of tree was $8\sqrt{3}$ m .

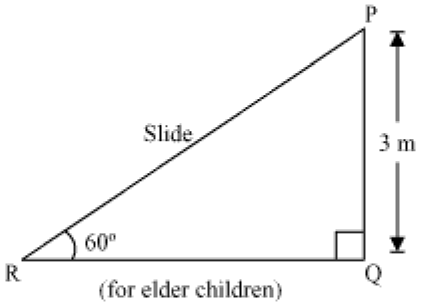
Solution 3

In the two figures, AC and PR are the slides for younger and elder children respectively



In ΔABC,

$$\frac{AB}{AC} = \sin 30^\circ$$
$$\frac{1.5}{AC} = \frac{1}{2}$$
$$AC = 3 \text{ m}$$

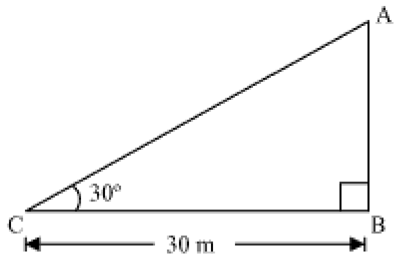


In ΔPQR,

$$\frac{PQ}{PR} = \sin 60$$
$$\frac{3}{PR} = \frac{\sqrt{3}}{2}$$
$$PR = \frac{6}{\sqrt{3}} = 2\sqrt{3} \text{ m}$$

Thus, the lengths of the two slides were 3 m and $2\sqrt{3}$ m .

Solution 4



Let AB be the tower.

In ΔABC,

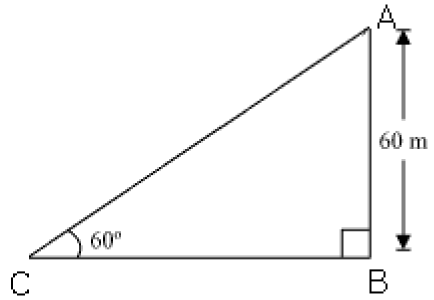
$$\frac{AB}{BC} = \tan 30°$$

$$\frac{AB}{30} = \frac{1}{\sqrt{3}}$$

$$AB = \frac{30}{\sqrt{3}} = 10\sqrt{3}\ \text{m}$$

Thus, the height of tower is $10\sqrt{3}$ m .

Solution 5



Let A be the position of the kite and the string is tied to point C on ground.

In ΔABC,

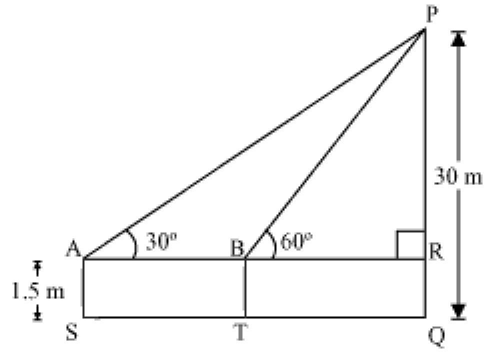
$$\frac{AB}{AC} = \sin 60°$$

$$\frac{60}{AC} = \frac{\sqrt{3}}{2}$$

$$AC = \frac{120}{\sqrt{3}} = 40\sqrt{3}\ \text{m}$$

Thus, the length of the string is $40\sqrt{3}$ m .

Solution 6



Let the initial position of the boy be S. He walks towards building and reached at point T.

In the figure, PQ is the building of height 30 m.

AS = BT = RQ = 1.5 m

PR = PQ − RQ = 30 m − 1.5 m = 28.5

In ΔPAR,

$$\frac{PR}{AR} = \tan 30^{o}$$
$$\frac{28.5}{AR} = \frac{1}{\sqrt{3}}$$
$$AR = 28.5\sqrt{3}$$

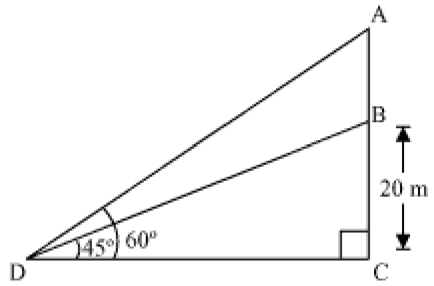
In ΔPRB,

$$\frac{PR}{BR} = \tan 60^{o}$$
$$\frac{28.5}{BR} = \sqrt{3}$$
$$BR = \frac{28.5}{\sqrt{3}} = 9.5\sqrt{3}$$

ST = AB = AR − BR = $28.5\sqrt{3} - 9.5\sqrt{3} = 19\sqrt{3}$

Thus, the distance which the boy walked towards the building is $19\sqrt{3}$ m.

Solution 7



Let BC be the building, AB be the transmission tower, and D be the point on ground from where elevation angles are to be measured.

In ΔBCD.

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

$$\frac{20}{CD} = 1$$

$$CD = 20 \text{ m} \quad \dots (i)$$

In ΔACD,

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

$$\frac{AB + BC}{CD} = \sqrt{3}$$

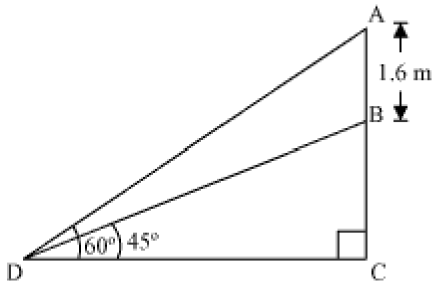
$$\frac{AB + 20}{20} = \sqrt{3} \qquad [\text{From(i)}]$$

$$AB = 20\sqrt{3} - 20$$

$$= 20\left(\sqrt{3} - 1\right)$$

Thus, the height of the tower is $20\left(\sqrt{3} - 1\right)$ m.

Solution 8



Let AB be the statue, BC be the pedestal and D be the point on ground from where elevation angles are to be measured.

In ΔBCD,

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

$$\frac{BC}{CD} = 1$$

$$BC = CD \qquad \dots (i)$$

In ΔACD,

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

$$\frac{AB + BC}{BC} = \sqrt{3} \qquad [\text{From (i)}]$$

$$1.6 + BC = BC\sqrt{3}$$

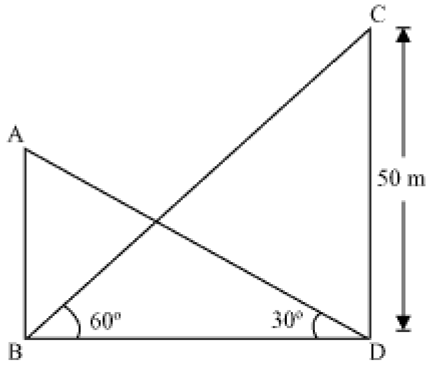
$$BC\left(\sqrt{3} - 1\right) = 1.6$$

$$BC = \frac{(1.6)\left(\sqrt{3} + 1\right)}{\left(\sqrt{3} - 1\right)\left(\sqrt{3} + 1\right)}$$

$$= \frac{1.6\left(\sqrt{3} + 1\right)}{2} = 0.8\left(\sqrt{3} + 1\right)$$

Thus, the height of pedestal is $0.8\left(\sqrt{3} + 1\right)$ m.

Solution 9



Let AB be the building and CD be the tower.

In ΔCDB,

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

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

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

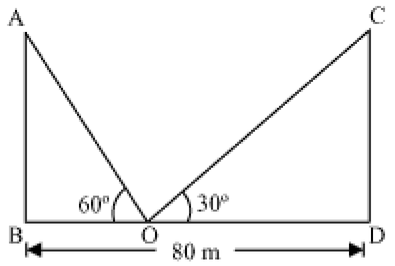
In ΔABD,

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

$$AB = \frac{50}{\sqrt{3}} \times \frac{1}{\sqrt{3}} = \frac{50}{3} = 16\frac{2}{3}$$

Thus, the height of the building is $16\frac{2}{3}$ m .

Solution 10



Let AB and CD be the poles and O is the point on the road.

In ΔABO,

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

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

$$BO = \frac{AB}{\sqrt{3}} \qquad \dots (i)$$

In ΔCDO,

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

$$\frac{CD}{80 - BO} = \frac{1}{\sqrt{3}}$$

$$CD\sqrt{3} = 80 - BO$$

$$CD\sqrt{3} = 80 - \frac{AB}{\sqrt{3}} \qquad \text{[From (i)]}$$

$$CD\sqrt{3} + \frac{AB}{\sqrt{3}} = 80$$

$$CD\left[\sqrt{3} + \frac{1}{\sqrt{3}}\right] = 80 \quad \text{(Since, } AB = CD\text{)}$$

$$CD\left(\frac{3+1}{\sqrt{3}}\right) = 80$$

$$CD = 20\sqrt{3}$$

$$BO = \frac{AB}{\sqrt{3}} = \frac{CD}{\sqrt{3}} = \frac{20\sqrt{3}}{\sqrt{3}} = 20 \text{ m}$$

$$DO = BD - BO = 80 \text{ m} - 20 \text{ m} = 60 \text{ m}$$

Thus, the height of the poles is $20\sqrt{3}$ m and the point between the poles is 20 m and 60 m far from these poles.

Solution 11

In ΔABC,

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

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

$$BC = \frac{AB}{\sqrt{3}} \qquad \dots \text{(i)}$$

In ΔABD,

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

$$\frac{AB}{BC + CD} = \frac{1}{\sqrt{3}}$$

$$\frac{AB}{\frac{AB}{\sqrt{3}} + 20} = \frac{1}{\sqrt{3}} \qquad \text{[From (i)]}$$

$$\frac{AB\sqrt{3}}{AB + 20\sqrt{3}} = \frac{1}{\sqrt{3}}$$

$$3AB = AB + 20\sqrt{3}$$

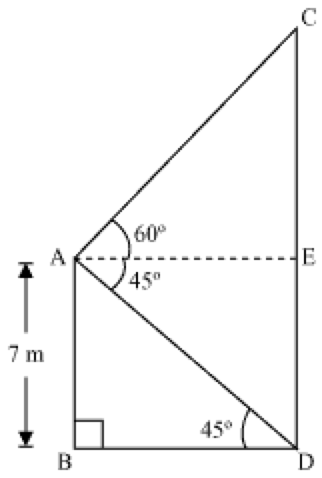
$$2AB = 20\sqrt{3}$$

$$AB = 10\sqrt{3}$$

$$\Rightarrow BC = \frac{AB}{\sqrt{3}} = \frac{10\sqrt{3}}{\sqrt{3}} = 10$$

Thus, the height of the tower is $10\sqrt{3}$ m and width of canal is 10 m.

Solution 12



Let AB be a building and CD be a cable tower.

In ΔABD,

$$\frac{AB}{BD} = \tan 45°$$

$$\frac{7 \text{ m}}{BD} = 1$$

$$BD = 7 \text{ m}$$

In ΔACE,

$$AE = BD = 7$$

$$\frac{CE}{AE} = \tan 60°$$

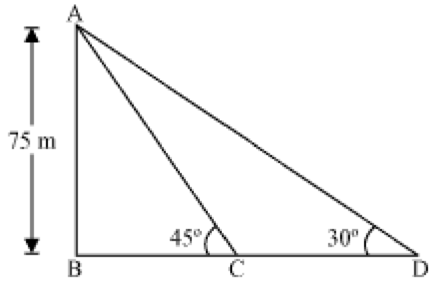
$$\frac{CE}{7 \text{ m}} = \sqrt{3}$$

$$CE = 7\sqrt{3} \text{ m}$$

$$CD = CE + ED = \left(7\sqrt{3} + 7\right) \text{ m} = 7\left(\sqrt{3} + 1\right) \text{ m}$$

Thus, the height of the cable tower is $7\left(\sqrt{3} + 1\right)$ m.

Solution 13



Let AB be the lighthouse and the two ships be at point C and D respectively.

In ΔABC,

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

$$\frac{75\ m}{BC} = 1$$

$$BC = 75\ m$$

In ΔABD,

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

$$\frac{75\ m}{BC + CD} = \frac{1}{\sqrt{3}}$$

$$\frac{75\ m}{75\ m + CD} = \frac{1}{\sqrt{3}}$$

$$75\sqrt{3}\ m = 75\ m + CD$$

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

Thus, the distance between the two ships is $75\left(\sqrt{3} - 1\right)$ m.
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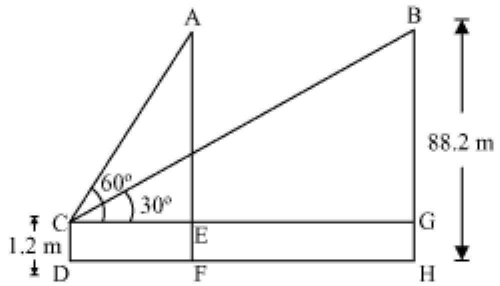
Solution 14



Let A be the initial position of the balloon and the position changes to B after some time and CD is the girl.

In ΔACE,

$$\frac{AE}{CE} = \tan 60^\circ$$

$$\frac{AF - EF}{CE} = \tan 60^\circ$$

$$\frac{88.2 - 1.2}{CE} = \sqrt{3}$$

$$\frac{87}{CE} = \sqrt{3}$$

In ΔBCG,

$$\frac{BG}{CG} = \tan 30^\circ$$

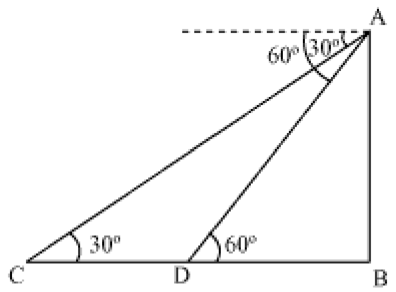
$$\frac{88.2 - 1.2}{CG} = \frac{1}{\sqrt{3}}$$

$$87\sqrt{3} = CG$$

Distance travelled by balloon = EG = CG − CE

$$= 87\sqrt{3} - 29\sqrt{3} = 58\sqrt{3}\ \text{m}$$

Solution 15



Let AB be the tower. C is the original position of the car which changes to D after six seconds.

In ΔADB,

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

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

$$DB = \frac{AB}{\sqrt{3}} \qquad \dots (i)$$

In ΔABC,

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

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

$$AB\sqrt{3} = BD + DC$$

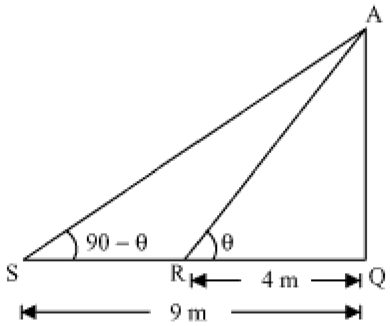
$$AB\sqrt{3} = \frac{AB}{\sqrt{3}} + DC \qquad \text{[From (i)]}$$

$$DC = AB\sqrt{3} - \frac{AB}{\sqrt{3}} = AB\left(\sqrt{3} - \frac{1}{\sqrt{3}}\right) = \frac{2AB}{\sqrt{3}}$$

Time taken by car to travel distance DC $\left(= \frac{2AB}{\sqrt{3}}\right) = 6$ seconds

Time taken by car to travel distance DB $\left(= \frac{AB}{\sqrt{3}}\right) = \frac{6}{\frac{2AB}{\sqrt{3}}} \times \frac{AB}{\sqrt{3}} = 3$ seconds

Solution 16



Let AQ be the tower and R, S respectively be the points which are 4m, 9m away from base of tower.

Let $\angle ARQ = \theta$, then $\angle ASQ = 90^\circ - \theta$

(Since, the angles are complementary)

In ΔAQR,

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

$$\frac{AQ}{4} = \tan\theta \qquad \ldots(i)$$

In ΔAQS,

$$\frac{AQ}{SQ} = \tan(90^\circ - \theta)$$

$$\frac{AQ}{9} = \cot\theta \qquad \ldots(ii)$$

Multiplying equations (i) and (ii),

$$\left(\frac{AQ}{4}\right)\left(\frac{AQ}{9}\right) = (\tan\theta).(\cot\theta)$$

$$\frac{AQ^2}{36} = 1$$

$$AQ^2 = 36$$

$$AQ = \sqrt{36} = \pm 6$$

As the height can not be negative, the height of the tower is 6 m.