Angle of Elevation & Depression

1. Direct
2. →
   ←

Line of Sight

Horizontal

Angle of Elevation

C ← B A E D

D - - - - - - - - - - - Depression B

Line of Sight

Horizontal

Angle of Depression

A C

root 3 = 1.73

CareerRide.com

Remembering Values

θ	0°	30°	45°	60°	90°
sin	0	½	1/√2	√3/2	1
cos	1	√3/2	1/√2	½	0
tan	0	1/√3	1	√3	undefined

1/sinθ = cosec θ   1/cosθ = sec θ   1/tanθ = cot θ

root 3 = 1.73

Q1. The angle of elevation of the top of a tree from a certain point is 45 degree. If the observer moves 30 m towards the tree, the angle of elevation becomes 60 degree. What is the height of the tree?
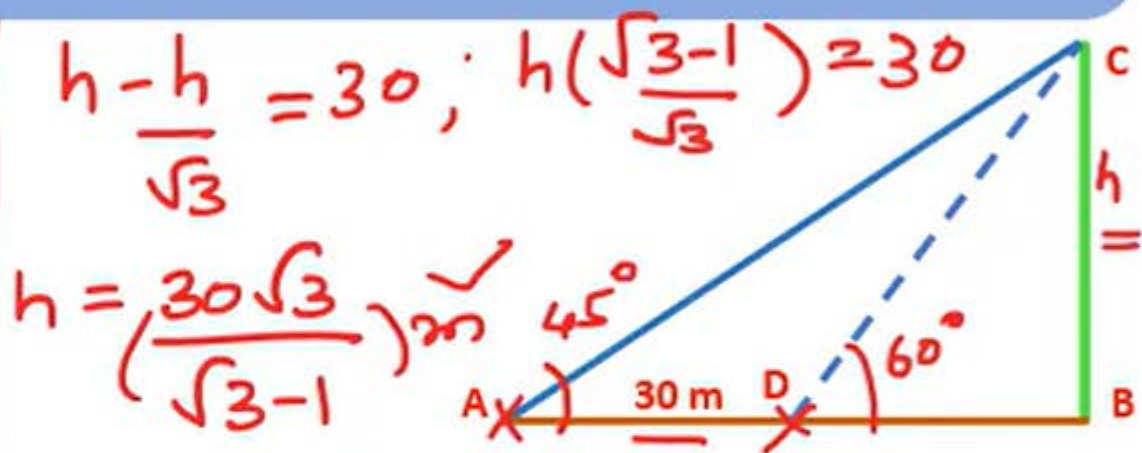
$$\tan\theta = \frac{P}{B}$$

ΔCDB

$$\tan 60° = \frac{h}{DB} = \sqrt{3}$$

$$DB = \frac{h}{\sqrt{3}} \quad —① $$

$\Delta CAB; \quad \tan 45° = \frac{h}{30 + DB}$

$$1 = \frac{h}{30 + DB} \Rightarrow h = 30 + DB \quad —②$$

$$h = 30 + \frac{h}{\sqrt{3}}$$

$$h - \frac{h}{\sqrt{3}} = 30 ; \quad h\left(\frac{\sqrt{3}-1}{\sqrt{3}}\right) = 30$$

$$h = \left(\frac{30\sqrt{3}}{\sqrt{3}-1}\right) \text{m} \quad \checkmark$$

$$\frac{30\sqrt{3}\,(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)}$$

$$\Rightarrow \sqrt{3} = 1.73$$

$$= \overset{2}{\underset{15}{\cancel{\frac{30}{}}}}\sqrt{3}(\sqrt{3}+1)$$

$$= \underline{[70.95\,m]}$$

45°

60°

A ⟋ 30 m D ⟋ C

h =

B

CareerRide.com

Q2. Tree top's angle of elevation is 30° from a point on ground, 300 m away from the tree. When the tree grew up its angle of elevation became 60° from the same point. How much did the tree grow?

$$\tan\theta = \frac{P}{B}$$

In $\triangle CAB$

$$\tan 30° = \frac{h}{300}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{300}$$

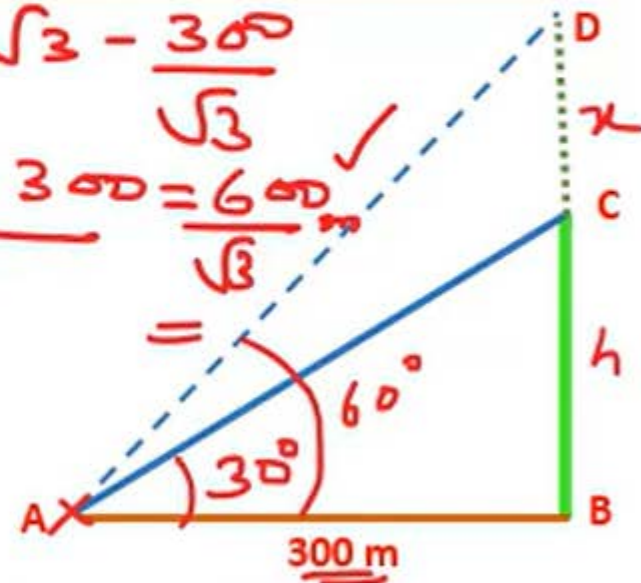$$h = \frac{300}{\sqrt{3}} \, m \quad \textcircled{1}$$

In $\triangle DAB$

$$\tan 60° = \frac{x+h}{300}$$

$$\sqrt{3} = \frac{x+h}{300}$$

$$x+h = 300\sqrt{3}$$

$$x + \frac{300}{\sqrt{3}} = 300\sqrt{3}$$

$$x = 300\sqrt{3} - \frac{300}{\sqrt{3}}$$

$$= \frac{900 - 300}{\sqrt{3}} = \frac{600}{\sqrt{3}} \, m \checkmark$$

$$=$$

Q3. There is a tower of 10m between two parallel roads. The angles of depression of the roads from the top of the tower are 30° and 45°. How far are the roads from each other?

$$\tan\theta = \frac{P}{B}$$
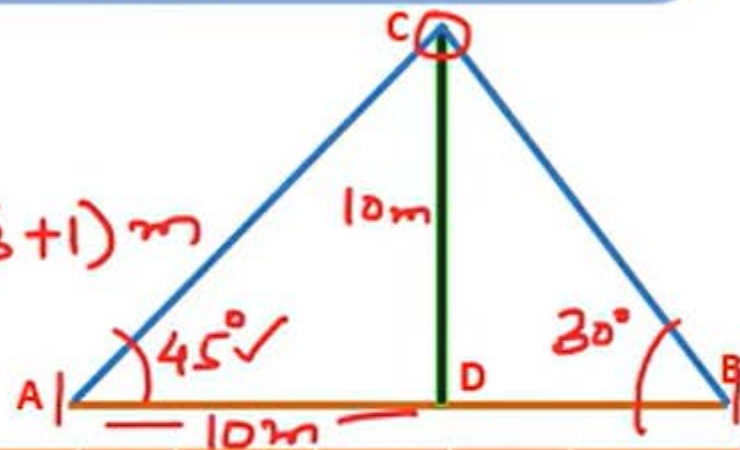
In $\triangle CAD$

$$\tan 45° = \frac{10}{AD} = 1$$

$$AD = 10m$$

In $\triangle CDB$

$$\tan 30° = \frac{10}{DB} = \frac{1}{\sqrt{3}}$$

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

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

$$= 10(1.73+1) = 27.3m$$

θ	0°	30°	45°	60°	90°
sin	0	½	1/√2	√3/2	1
cos	1	√3/2	1/√2	½	0
tan	0	1/√3	1	√3	UD

CareerRide.com

Q4. Ramesh and Suresh's mud forts have heights 8cm and 15 cm. They are 24 cm apart. How far are the fort tops from each other?
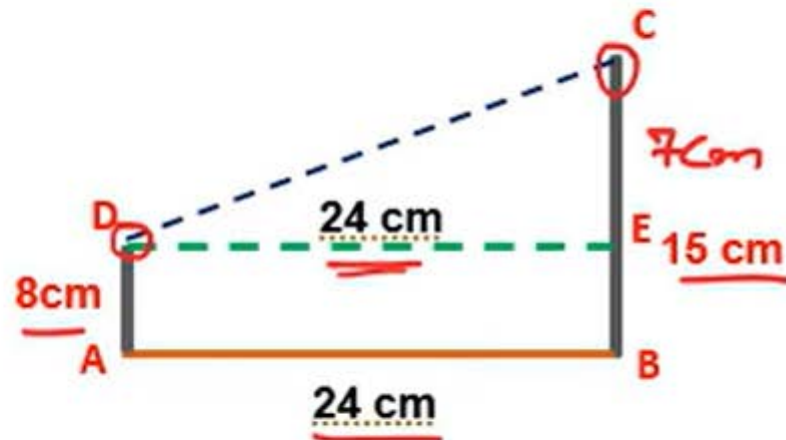
$AD = 8\,cm$

$CB = 15\,cm$

$CE = CB - EB = 15 - 8 = 7\,cm$

$\triangle CDE$

$H^2 = 7^2 + (24)^2$

$H = 25\,cm \rightarrow D.C.$

Q5. Guddi was standing on a road near a mall. She was 1000m away from the mall and able to see the top of the mall from the road in such a way that top of the tree, which is in between her and the mall, was exactly in line of sight with the top of the mall. The tree height is 10m and it is 20m away from Guddi. How tall is the mall? ✓
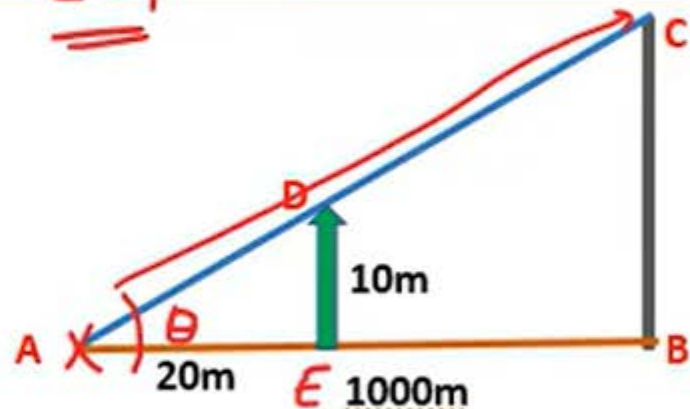
EASY

$\triangle\ DAE$

$$\tan\theta = \frac{DE}{AE} = \frac{10}{20} = \frac{1}{2} \quad —①$$

$\triangle\ CAB$

$$\tan\theta = \frac{CB}{AB} = \frac{1}{2} \quad —②$$

$$\frac{CB}{1000} = \frac{1}{2} \; ; \; CB = 500\ m \rightarrow \text{tall mall}$$

10m

20m

1000m

Q6. A light house is built to give directions to the sailing ships. It observes that a ship is sailing towards it in a straight line, at a uniform speed. It also notices the angle of depression to change from 30 degree to 45 degrees in 15 minutes. How soon will the ship reach the lighthouse? (Assume the water to be still) EASY

In $\triangle CDB$; $\tan 45° = \dfrac{h}{y} = 1 \Rightarrow h = y$ —①✓

In $\triangle CAB$; $\tan 30° = \dfrac{h}{AD + DB} = \dfrac{h}{x+h} = \dfrac{1}{\sqrt{3}}$

$\sqrt{3}h = x + h$; $\underline{x = h(\sqrt{3}-1)} \Rightarrow 15\text{min A.X}$

$$\dfrac{h(\sqrt{3}-1)}{h} \quad \dfrac{15}{}$$

$h = \dfrac{15}{h(\sqrt{3}-1)} \times k = \dfrac{15}{.73}\text{min} = \dfrac{1500}{73} = 20.94\text{min}$

CareerRide.com

Q7. Ram stands on the top of a building and observes a car going away from the building. When the car is 60 m from building, angle of depression is 45 degree. After 5 seconds, it is 30 degree. What is the speed of the car?

EASY

In $\triangle CDB$; $\tan 45° = \dfrac{h}{60} = 1$; $h = 60m$

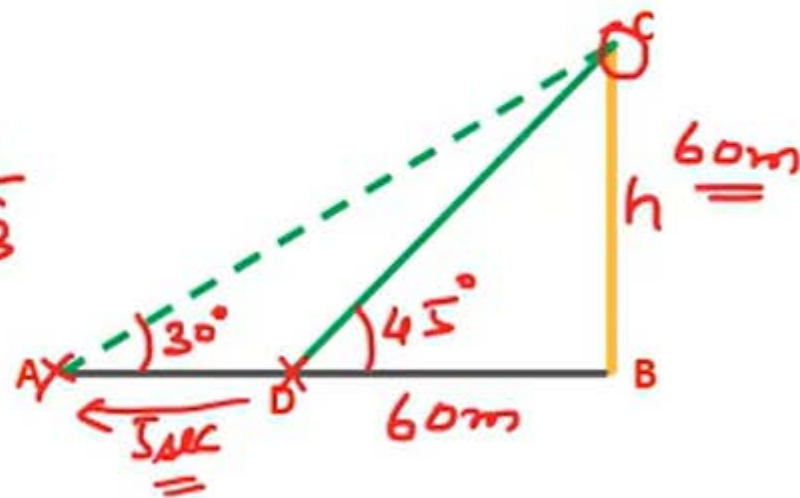$\triangle CAB$; $\tan 30° = \dfrac{60}{AB} = \dfrac{60}{AD + 60} = \dfrac{1}{\sqrt{3}}$

$60\sqrt{3} = AD + 60$; $AD = 60(\sqrt{3} - 1)$

$= 60(1.73 - 1)$

$= 43.8m = AD \rightarrow 5sec$

$S = \dfrac{D}{T} = \dfrac{43.8m}{5\,sec}$

$= 8.76\,m/s$.

CareerRide.com

Q8. Angles of elevation of pole are 60° and 45° from points at distances m and n on ground respectively. Here m, when measured from base of pole is less than n. What is the height of the pole?

$\triangle CAB$ $\tan 45° = \dfrac{CB}{n} = 1$ —①

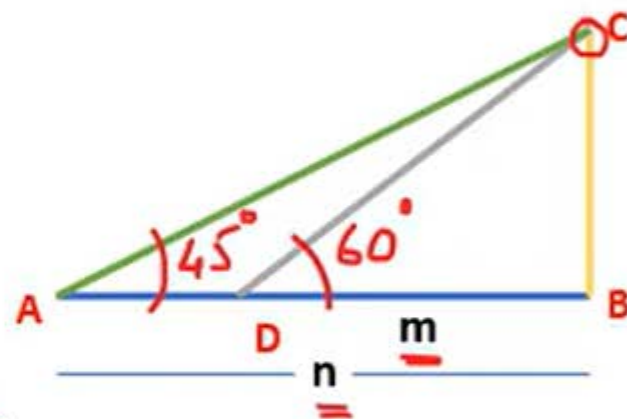$\triangle CDB$ $\tan 60° = \dfrac{CB}{m} = \sqrt{3}$ —②

①×②

$\dfrac{CB}{n} \times \dfrac{CB}{m} = 1 \times \sqrt{3}$

$= \dfrac{(CB)^2}{mn} = \sqrt{3}$

$(CB)^2 = \sqrt{3}\,(mn)$

$CB = \sqrt{mn\sqrt{3}}$ ✓

Practice Questions

Q1. A man is standing at the top of a building. His wife is at the ground, some distance away from the building. When both of them look at each other, is the angle of elevation equal to angle of depression or lesser?

Q2. A parachute is flying in the sky. The angle of elevation of the parachute from a point 150 m above a lake is 30 degree and angle of depression of its reflection in the lake is 60 degree. At what height is the parachute from the water surface?