

Heights and Distance

1. A 1.5 m tall boy is standing at some distance from a 30 m tall building. The angle of elevation from his eyes to the top of the building increases from 30° to 60° as he walks towards the building. Find the distance he walked towards the building. Ans: $19\sqrt{3} m$
2. A vertical tower is surmounted by flagstaff of height h metres. At a point on the ground, the angles of elevation of the bottom and top of the flagstaff are α and β respectively. Prove that the height of the tower in metres is
$$\frac{h \tan \alpha}{\tan \beta - \tan \alpha}.$$
3. From an aeroplane vertically above a straight horizontal plane, the angles of depression of two consecutive kilometer stones on the opposite side of the aeroplane are found to be α and β . Show that the height of the aeroplane, in kilometers is
$$\frac{\tan \alpha \tan \beta}{\tan \alpha + \tan \beta}.$$
4. A 1.2 m tall girl spots a balloon moving with the wind in a horizontal line at a height of 88.2 m from the ground. The angle of elevation of the balloon from the eyes of the girl at any instant is 60° . After some time, the angle of elevation reduces to 30° . Find the distance traveled by the balloon during the interval. Ans: $58\sqrt{3} m$
5. From a window p meters high above the ground in a street, the angles of elevation and depression of the top and the foot of another house on opposite side of the street are θ and ϕ respectively. Show that the height of the opposite house, in metres is $p(1 + \tan \theta \cot \phi)$.
6. If the angle of elevation of a cloud from a point h meters above a lake is α and the angle of depression of its reflection in the lake is β , prove that the distance of the cloud from the point of observation is
$$\frac{2h \sec \alpha}{\tan \beta - \tan \alpha}$$
 meters.
7. A round balloon of radius r subtends an angle α at the eye of the observer while the angle of elevation of its centre is β . Prove that the height of the centre of the balloon is $r \sin \beta \operatorname{cosec} \frac{\alpha}{2}$.
8. At the foot of a mountain, the angle of elevation of its summit is 45° . After ascending 1 km towards the mountain up an incline of 30° , the elevation changes to 60° . Find the height of the mountain. Ans: 1.36 km
9. A man standing on a horizontal plane finds a bird flying at a distance of 100 m from him at an elevation of 30° . A girl standing on the roof of a 20 m high building finds the angle of elevation of the same bird to be 45° . Boy and girl are on the opposite sides of the bird. Find the distance of the bird from the girl. 42.3 m
10. A marble statue of height h_1 metres is mounted on a pedestal. The angles of elevation of the top and the bottom of the statue from a point h_2 metres above

the ground level are α and β respectively. Show that the height of the pedestal is $\frac{(h_1 - h_2) \tan \beta + h_2 \tan \alpha}{\tan \alpha - \tan \beta}$.

11. The angles of elevation of an aeroplane flying in a horizontal straight line, from a fixed point at four successive observations are α, β, γ and δ , the observations being taken at equal intervals of time. Assuming that the speed of the aeroplane is uniform, show that $3(\cot^2 \beta - \cot^2 \gamma) = (\cot^2 \alpha - \cot^2 \delta)$.
12. A man standing at a point P is watching the top of a tower, which makes an angle of elevation of 30° with the man's eye. The man walks some distance towards the tower to watch its top and the angle of the elevation becomes 60° . What is the distance between the base of the tower and the point P? Ans: Cannot be solved from the given data.

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