

Heights and Distances

1. An aero plane flying horizontally 1 km above the ground is observed at an elevation of 60° . After 10 seconds, its elevation is observed to be 30° . Find the speed of the aero plane in km/hr.
2. From a window h metres high above the ground of a house in a street, the angle of elevation and depression of the top and the foot of another house on the opposite side of the street are θ and α respectively. Show that the height of the opposite house is $h(1 + \tan \theta \cot \alpha)$.
3. The angle of elevation, θ of a vertical tower from a point A on ground is such that its tangent is $\frac{5}{12}$. On walking 192m towards the tower in the same straight line, the tangent of the angle of elevation ϕ is found to be $\frac{3}{4}$. Find the height of the tower.
4. There is a small island in the middle of a 100m wide river and a tall tree stands on the island. P and Q are points directly opposite each other on the two banks and in line with the tree. If the angles of elevation of the top of the tree from P and Q are respectively 30° and 45° , find the height of the tree.
5. A vertical tower stands on a horizontal plane and a surmounted by a flagstaff of height 3.5m. From a point on the plane the angle of elevation of the bottom of the flagstaff is 30° and that of the top of the flagstaff is 45° . Find the height of the tower.
6. A man on a cliff observes a boat at angle of depression of 30° which is approaching the shore to point immediately beneath the observer with a uniform speed. Ten minutes later, the angle of depression of the boat is found to be 60° . Find the time taken by the boat to reach the shore.
7. At the foot of a mountain the elevation of its summits is 45° . After ascending 2 km towards its summit on a 30° inclination, the elevation becomes 60° . What is the height of the mountain?
8. The angle of elevation of a jet plane from a point P on the ground is 60° . After a flight of 15 seconds, the angle of elevation changes to 30° . If the jet plane is flying at a constant height of $1500\sqrt{3}$ m, find the speed of the jet plane.
9. 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 $r \sin \beta \operatorname{cosec} \frac{\alpha}{2}$.

10. A fire in a building B is reported on phone to two fire stations E and F, 10km apart from each other on a straight road. E observes that the fire is at an angle of 60° to the road and F observes that it is at an angle of 45° to the road. Which station should send its team and how much will the team have to travel?
11. A boy is standing on the ground and flying a kite with 100m of string at an elevation of 30° . Another boy is standing on the roof of a 10m high building and is flying his kite at an elevation of 45° . Both the boys are on opposite sides of both the kites. Find the length of the string that the second boy must have so that the two kites meet.
12. If the angle of elevation of a cloud from a point h metres 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 $\frac{2 h \tan \alpha}{\tan \beta - \tan \alpha}$.

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