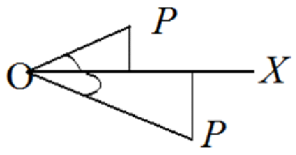
20 HEIGHTS AND DISTANCES

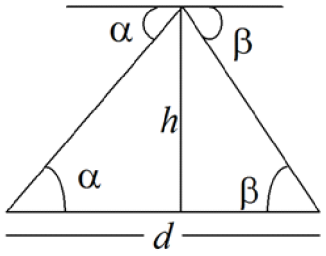
SYNOPSIS

1. If the object P is above the horizontal OX, through the observation point O, then $\angle XOP$ is angle of elevation. If the object P is below the horizontal OX through the observation point O, then $\angle XOP$ is angle of depression.

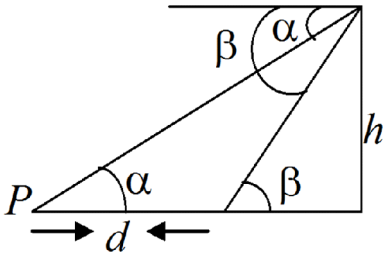


2. From two points on either side of a tower, d unit's apart on the line through the foot of the tower, if the angles of elevation of the top of the tower are α and β, then height of tower

$$h = \frac{d}{\cot\alpha + \cot\beta} = \frac{d\sin\alpha\sin\beta}{\sin(\alpha+\beta)}$$

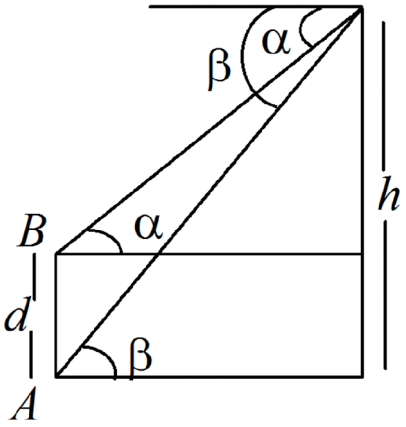


3. The angle of elevation of an object from a point P on the level ground is α. Moving d meters on the ground towards the object, the angle of elevation is found to be β. Then the height (in meters) of the object $h = \frac{d}{\cot\alpha - \cot\beta} = \frac{d\sin\alpha\sin\beta}{\sin(\beta-\alpha)}$



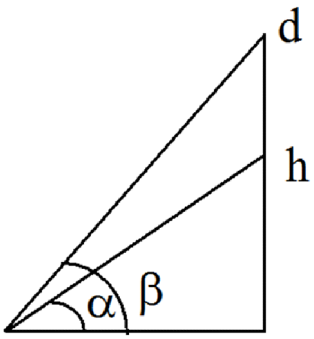
4. The angles of elevations of the top of the tower from a point A on the ground and a point B vertically above A at a height of 'd' units are β and α respectively. The height of the tower

$$h = \frac{d\ \cot\ \alpha}{\cot\alpha - \cot\beta} = \frac{d\cos\alpha\sin\beta}{\sin(\beta-\alpha)}$$

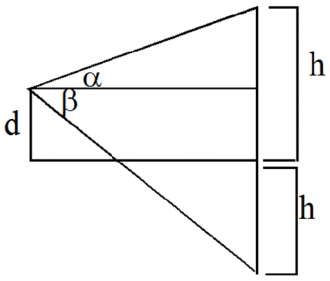


5. A flag - staff of length '*d*' mt stand on a tower '*h*' mt. From a point on the ground, the angles of elevations of the foot and the top of the flag staff are α and β respectively, then the height of the tower

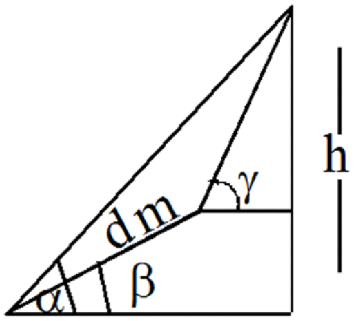
$$h = \frac{d\cot\beta}{\cot\alpha - \cot\beta} = \frac{d\sin\alpha\cos\beta}{\sin(\beta-\alpha)}$$



6. If the angle of elevation of a cloud from an observation at a height '*d*' from a water level is α and angle of depression of the image of cloud in the lake is β, then height of the cloud $h = \frac{d\ \sin(\beta+\alpha)}{\sin(\beta-\alpha)}$



7. If the angle of elevation of the top of the tower from a point is α and after walking a distance "d" along a path inclined at angle β to the horizontal, the angle of elevation of the top of the tower is then height of the tower $h = \dfrac{d \sin(\gamma - \beta) \sin\alpha}{\sin(\gamma - \alpha)}$



8. m-n Rule or cotangent Rule:

$(m + n) \cot\theta = m\cot\alpha - n\cot\beta = n\cot\gamma - m\cot\delta$

