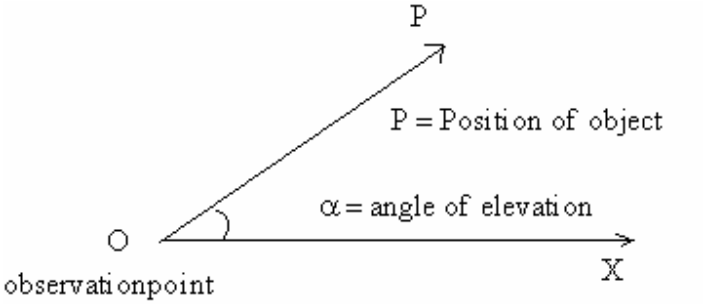
16. HEIGHTS AND DISTANCES

Synopsis :

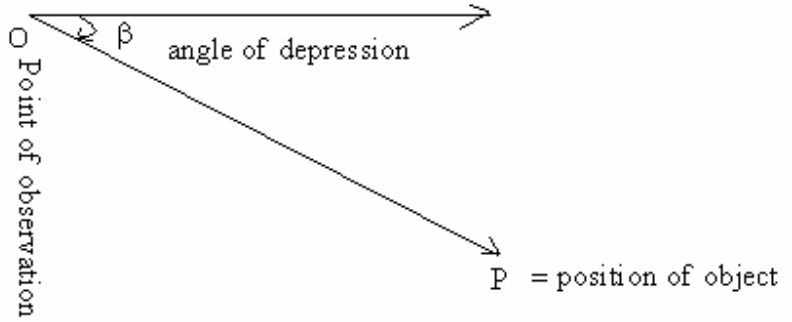
ANGLE OF ELEVATION

1. If the position of the object is above the position of the observation then the angle made by the line joining object and observation point with the horizontal line drawn at the observation point is called angle of elevation.



ANGLE OF DEPRESSION:

2. If the position of the object is below the position of the observation the angle made by the line joining object and observation point with the horizontal line drawn at the observation point is called angle of depression.



3. a. The angle of elevation of the top of a tower, standing on a horizontal plane, from a point A is . After walking a distance 'd' metres towards the foot of the tower, the angle of elevation is found to be β .

   The height of the tower h = $\frac{d \sin\beta \sin\alpha}{Sin(\beta - \alpha)}$

   (or) $h = \frac{d}{Cot\alpha - \cot\beta}$

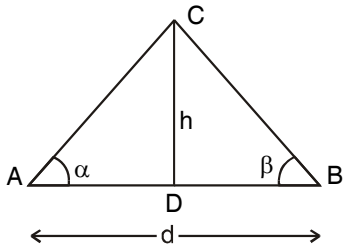
   Where $\overline{AB} = d$

4. If the Points of observation A and B lie on either side of the tower, then height of the tower

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

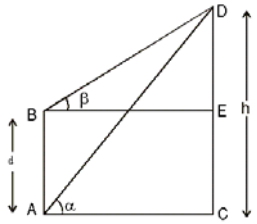
   Where $\overline{AB} = d$

(or) $h = \dfrac{d}{Cot\alpha + \cot\beta}$



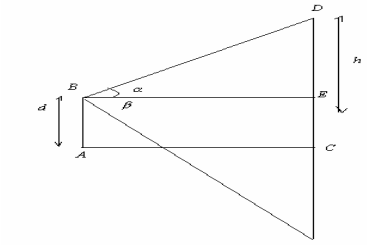
5. The angles of elevation of the top of a tower from the bottom and top of a building of height 'd' metres are β and α respectively. The height of the tower is

h = $\dfrac{d\sin\beta\cos\alpha}{\sin(\beta-\alpha)}$ metres (or) $h = \dfrac{d\cot\alpha}{\cot\alpha - \cot\beta}$



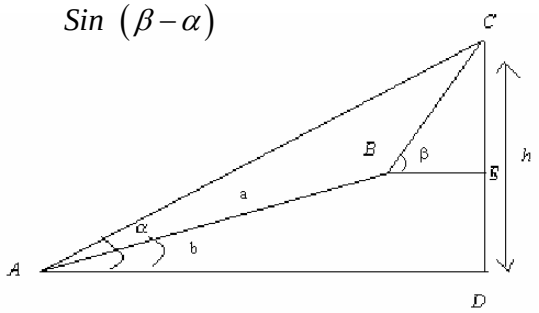
6. The angle of elevation of a cloud from a height 'd' metres above the level of water in a lake is 'α' and the angle of depression of its image in the lake is β . The height of the cloud from the water level in metres is

$h = \dfrac{d\ \sin\ (\beta+\alpha)}{\sin\ (\beta-\alpha)}$ **(or)** $h = \left[\dfrac{d\ (\tan\beta+\tan\alpha)}{(\tan\beta-\tan\alpha)}\right]$ **(or)** $h = d\ \left[\dfrac{Cot\ \alpha\ +\ Cot\beta}{Cot\alpha\ -\ Cot\ \beta}\right]$



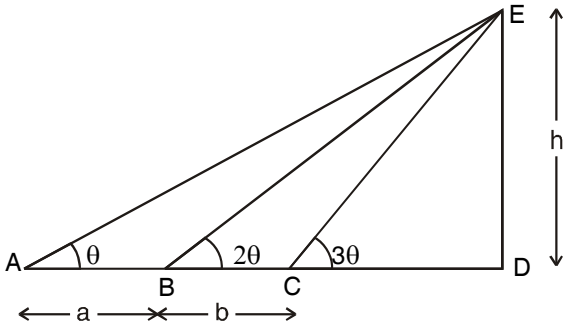
7. The angle of elevation of a hill from a point A is 'α' . After walking to some point B at a distance 'a' metres from A on a slope inclined at 'γ' to the horizon, the angle of elevation was found to be β .

Height of the hill $h = \dfrac{a\ Sin\ \alpha\ Sin\ (\beta-\gamma)}{Sin\ (\beta-\alpha)}$



8. A balloon is observed simultaneously from the three points A, B, C on a straight road directly beneath it. The angular elevation at B is twice that at A and the angular elevation at 'C' is thrice that at A. If AB=a and BC=b then the height of the balloon h in terms of a and b is,

$$h = \frac{a}{2b}\sqrt{(3b-a)\ (a+b)}$$



9. A flag staff stands on the top of a tower of height h metres. If the tower and flag staff subtend equal angles at a distance 'd' metres from the foot of the tower, then the height the flag - staff in metres is $h\left[\frac{d^2+h^2}{d^2-h^2}\right]$

