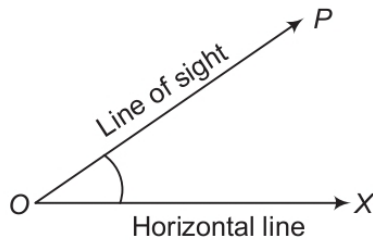# Heights and Distances

Height and distance is the important application of Trigonometry, in which we measure the height and distance of different object as towers, building etc.
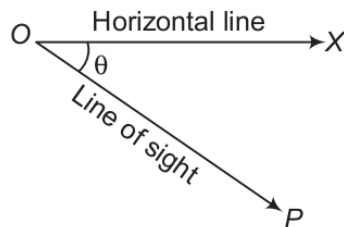
Angle of Elevation

If O be the observer's eye and OX be the horizontal line through O.

If the object P is at higher level than eye, then $\angle POX$ is called the angle of elevation.

Angle of Depression

If the object P is a lower level than O, then $\angle POX$ is called the angle of depression.
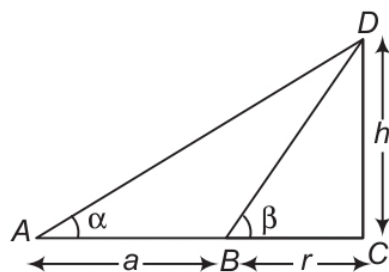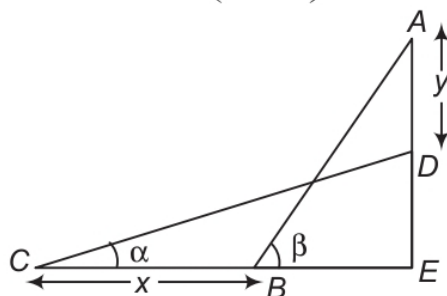

Note

    (i) Angle of elevation and depression are always acute angle.

    (ii) Angle of elevation of an object from an observer is same as angle of depression of an observer from the object.

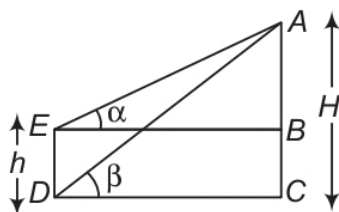# Important Results on Height and Distance

(i) $a = h\,(\cot\alpha - \cot\beta)$

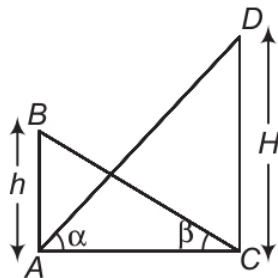(ii) If $AB = CD$, then $x = y\tan\left(\dfrac{\alpha+\beta}{2}\right)$

(iii) $h = \dfrac{H\,\sin(\beta-\alpha)}{\cos\alpha\,\sin\beta}$
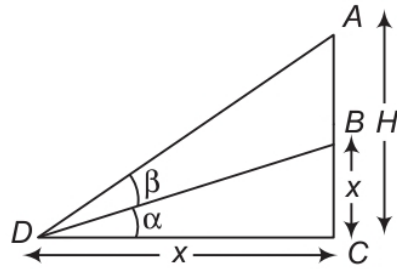
and $H = \dfrac{h\cot\alpha}{\cot\alpha - \cot\beta}$

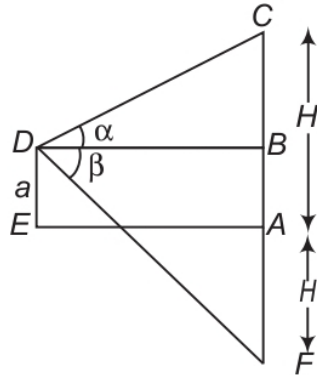$\Rightarrow\quad H = x\cot\alpha\,\tan(\alpha+\beta)$

(iv) $H = \dfrac{h\cot\beta}{\cot\alpha}$

(v) $H = x \cot\alpha \, \tan(\alpha + \beta)$

(vi) $H = \dfrac{\alpha \sin(\alpha + \beta)}{\sin(\beta - \alpha)}$

(vii) $a = h\,(\cot\alpha + \cot\beta)$

$h = a \sin\alpha \, \sin\beta \, \cosec(\alpha + \beta)$

and $d = h \cot\beta = a \sin\alpha \, \cos\beta \, \cosec(\alpha + \beta)$