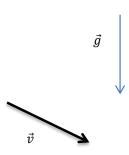
A particle is projected from a point A at an angle(Q) with the horizontal. At B it moves at right angle to its initial direction. Find time of Flight from A to B.





 $\overrightarrow{v_0}$  - vector of initial velocity

 $ec{v}$  - vector of current velocity

Suppose, at the time instant  $\;t\;\overrightarrow{v_0}\;$  is perpendicular to  $\vec{v}.$  Then:

$$\overrightarrow{v_0} * \overrightarrow{v} = 0$$

On the other hand:

$$\vec{v} = \overrightarrow{v_0} + \vec{g}t,$$

where  $\vec{g}$  – gravitational acceleration.

Therefore:

$$(\overrightarrow{v_0} + \overrightarrow{g}t) * \overrightarrow{v_0} = 0$$

$$\overrightarrow{v_0}^2 + (\vec{g} * \overrightarrow{v_0})t = v_0^2 + gv_0 \cos(a) t = 0$$

where a – angle between  $\vec{g}$  and  $\overrightarrow{v_0}$ , a=90+Q

$$v_0^2 - gv_0\sin(Q)\,t = 0$$

$$t = \frac{v_0}{gsin(Q)}$$

Answer: 
$$t = \frac{v_0}{gsin(Q)}$$