

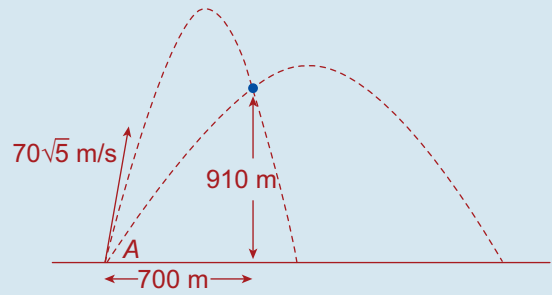
Q. 4. $u_x = 70\sqrt{5} \cos A$ $u_y = 70\sqrt{5} \sin A$

$v_x = 70\sqrt{5} \cos A$

$v_y = 70\sqrt{5} \sin A - gt$

$s_x = 70t\sqrt{5} \cos A$

$s_y = 70t\sqrt{5} \sin A - \frac{1}{2}gt^2$



(i) $s_x = 700$ when $s_y = 910$

$70t\sqrt{5} \cos A = 700$ when $70t\sqrt{5} \sin A - \frac{1}{2}gt^2 = 910$

$\Rightarrow t = \frac{700}{70\sqrt{5} \cos A}$

$\Rightarrow t = \frac{10}{\sqrt{5} \cos A}$

$\frac{\sin A}{\cos A} = \tan A$

$\frac{1}{\cos^2 A} = 1 + \tan^2 A$

$\Rightarrow 70 \left[\frac{10}{\sqrt{5} \cos A} \right] \sqrt{5} \sin A - \frac{1}{2}g \left[\frac{100}{5 \cos^2 A} \right] = 910$

$\Rightarrow 700 \tan A - 10g(1 + \tan^2 A) = 910$

$\Rightarrow 700 \tan A - 98 - 98 \tan^2 A = 910$

$\Rightarrow 98 \tan^2 A - 700 \tan A + 1,008 = 0$... divide by 14

$\Rightarrow 7 \tan^2 A - 50 \tan A + 72 = 0$... let $x = \tan A$

$\Rightarrow 7x^2 - 50x + 72 = 0$

$\Rightarrow (7x - 36)(x - 2)$

$\Rightarrow x = \frac{36}{7}$ OR $x = 2$

$\Rightarrow \tan A = \frac{36}{7}$ OR $\tan A = 2$

$\Rightarrow x = 79^\circ$ OR $x = 63^\circ$

(ii) First particle is fired at an angle A where $\tan A = \frac{36}{7} \Rightarrow \cos A = \frac{7}{\sqrt{1,345}}$

Time of Flight: Let $s_x = 700$ (flight ends when it hits the target)

$\Rightarrow 70t\sqrt{5} \cos A = 700$

$\Rightarrow t\sqrt{5} \cos A = 10$

$\Rightarrow t = \frac{10}{\sqrt{5} \cos A}$

$= \frac{2\sqrt{5}}{\cos A}$

$= 2\sqrt{5} \left[\frac{\sqrt{1,345}}{7} \right] = 23.43 \text{ s}$

Second particle is fired at an angle A where $\tan A = 2 \Rightarrow \cos A = \frac{1}{\sqrt{5}}$

Time of Flight: Let $s_x = 700$

$\Rightarrow 70t\sqrt{5} \cos A = 700$

$\Rightarrow t = \frac{2\sqrt{5}}{\cos A}$

$= 2\sqrt{5} \left[\frac{\sqrt{5}}{1} \right] = 10 \text{ s}$

(iii) $23.43 - 10 = 13.43$

$\Rightarrow 13.5$ seconds elapses between 1st and 2nd hit to the nearest half second.