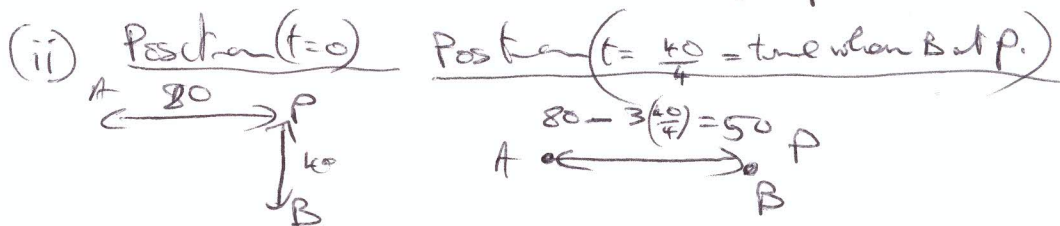


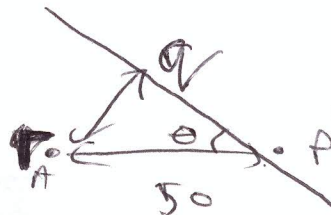
HLK 94 : Q2

Intersection is called pt P

(i) $\vec{v}_A = 3\vec{i}$
 $\vec{v}_B = 4\vec{j}$
 $\vec{v}_{BA} = \vec{v}_B - \vec{v}_A$
 $\vec{v}_{BA} = 4\vec{j} - 3\vec{i}$
 $|\vec{v}_{BA}| = 5$



Closest together :



Shortest distance = $|\vec{r}_q| = 50 \sin \theta = 80 \left(\frac{4}{5}\right) = 40 \text{m}$.

$\therefore |\vec{PQ}| = 30 \text{m}$.

Time to reach q from P = $\frac{|\vec{PQ}|}{|\vec{v}_{BA}|} = \frac{30}{5} = 6 \text{seconds}$

Time after start is $10 + 6 = 16 \text{seconds}$.

\therefore when closest together A is $(80 - 3(16)) = 80 - 48 = 32 \text{m from P}$
 and B is $(40 - 4(16)) = -24 \text{m} = 24 \text{m beyond P}$.

(8) $\leftarrow 80 \rightleftarrows$ $\downarrow 40$ $t=0$

A / $\vec{u}_A = 3\vec{i} \text{ m/s}$ $\vec{u}_B = 4\vec{j} \text{ m/s}$
 $\vec{a}_A = 0 \text{ m/s}^2$ $\vec{a}_B = -g\vec{j} \text{ m/s}^2$
 $\vec{v}_A = (3 + 0t)\vec{i} \text{ m/s}$ $\vec{v}_B = (4 - gt)\vec{j} \text{ m/s}$

(i) $\vec{v}_{BA} = \vec{v}_B - \vec{v}_A$
 $\vec{v}_{BA} = (4 - gt)\vec{j} - (3 + 0t)\vec{i} = -(3 + 0t)\vec{i} + (4 - gt)\vec{j} \text{ m/s}$.

(ii) Must find q so that A, B arrive at P simultaneously.

Find time takes A to reach q :

$S = 80 \Rightarrow 3t + \frac{1}{2}(0)t^2 = 80$
 $\Rightarrow t^2 + 60t - 1600 = 0$
 $\Rightarrow (t - 20)(t + 80) = 0$
 $\Rightarrow t = 20 \text{ (or } -80)$.

\therefore For B to arrive at same time :

for B $\left. \begin{array}{l} S = 40 \\ t = 20 \\ u = 4 \\ a = -g \end{array} \right\} S = ut + \frac{1}{2}at^2 \Rightarrow 40 = 4(20) + \frac{1}{2}(-g)(20)^2$
 $\Rightarrow 40 = 80 - 200g$
 $\Rightarrow -40 = -200g$
 $\Rightarrow \frac{4}{20} = g$
 $\Rightarrow \frac{1}{5} = g$
 $\frac{1}{5} \text{ m/s}^2$