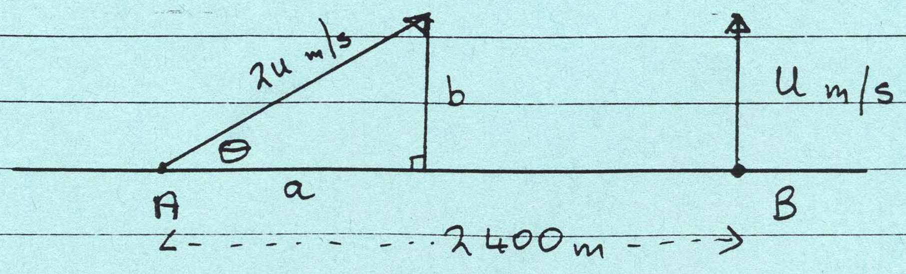
1988 2b H.L.



$$\vec{V}_A = a\vec{i} + b\vec{j} \quad : \quad a^2 + b^2 = (2u)^2 = 4u^2$$

$$\vec{V}_{AB} = \vec{V}_A - \vec{V}_B$$
$$= a\vec{i} + (b-u)\vec{j}$$

For interception $\vec{V}_{AB} \parallel \vec{AB}$ i.e. in $\vec{i}$ direction or

$$\Rightarrow \quad b = u \quad \text{and} \quad a = \sqrt{3}\,u$$

$$\Rightarrow \quad \theta = \tan^{-1}\left(\frac{b}{a}\right) = \tan^{-1}\left(\frac{u}{\sqrt{3}u}\right) = 30^\circ$$

$$\vec{V}_{AB} = \sqrt{3}\,u\,\vec{i} \quad : \quad |AB| = 2400 \text{ m.}$$

$$\text{Time to intercept} = \frac{2400}{\sqrt{3}u} = \frac{800\sqrt{3}}{u} \text{ secs.}$$

1976 Q1 H.L.

1. Show that, if a particle is moving in a straight line with constant acceleration k and initial speed u, the distance travelled in time t is given by $s = ut + \frac{1}{2}kt^2$. Two points a and b are a distance l apart. A particle starts from a and moves towards b in a straight line with initial velocity u and constant acceleration k. A second particle starts at the same time from b and moves towards a with initial velocity $2u$ and constant deceleration k. Find the time in terms of u, l at which the particles collide, and the condition satisfied by u, k, l if this occurs before the second particle returns to b.

	a	b	
Coords	0	l	X axis
vel.	$\rightarrow$ u m/s	2u m/s $\leftarrow$	
acc.	$\rightarrow$ k m/s^2	$\rightarrow$ k m/s	

$$\text{Rel. acc} = 0 \quad : \quad \vec{V}_{ab} = u - (-2u) = 3u.$$

$$\text{Time to collide} = \frac{l}{3u} \text{ secs}$$