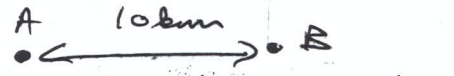
1973

$\vec{v}_A = 5\sqrt{3}\vec{i} + 5\vec{j}$.

Call $\vec{v}_B = m\vec{i} + n\vec{j}$.

$\vec{v}_{AB} = x\vec{i}$.



position

($\vec{v}_{AB}$ must be along the direction of $\vec{r}_{AB}$ if they are to collide)

$\vec{v}_{AB} = \vec{v}_A - \vec{v}_B$

$\Rightarrow \vec{v}_B = -\vec{v}_{AB} + \vec{v}_A$.

$\rightarrow m\vec{i} + n\vec{j} = -x\vec{i} + 5\sqrt{3}\vec{i} + 5\vec{j}$.

$(\vec{i}) \Rightarrow m = -x + 5\sqrt{3}$ and $(\vec{j})$ $n = 5$

for minimum $\vec{v}_B$ must have in fact $m = 0$,

$\therefore \vec{v}_B = 0\vec{i} + 5\vec{j}$. is minimum speed to give collision

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$\vec{v}_A = 5\sqrt{3}\vec{i} + 5\vec{j}$.

$\vec{v}_B = 6\cos\theta\,\vec{i} + 6\sin\theta\,\vec{j}$.

$\vec{v}_{AB} = x\vec{i}$.

$\vec{v}_B = \vec{v}_A - \vec{v}_{AB}$

$6\cos\theta\,\vec{i} + 6\sin\theta\,\vec{j} = 5\sqrt{3}\vec{i} + 5\vec{j} - x\vec{i}$.

or

$\vec{v}_B = h\vec{i} + 5\vec{j}$.

$|\vec{v}_B| = 6$

$\Rightarrow h^2 + 5^2 = 6^2$

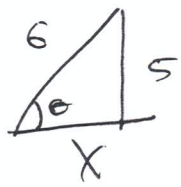
$\Rightarrow h = \pm\sqrt{11}$

$\Rightarrow (\vec{i}) \Rightarrow 6\cos\theta = 5\sqrt{3}$ ✗.

and $(\vec{j}) \Rightarrow 6\sin\theta = 5$. $\Rightarrow \sin\theta = \frac{5}{6}$.

////

TRIG



$5^2 + x^2 = 6^2$.

$25 + x^2 = 36$

$x^2 = 11 \Rightarrow x = \sqrt{11}$.

$\Rightarrow \cos\theta = \pm\frac{\sqrt{11}}{6}$ for $0 < \theta < 90$. ////

$\therefore \vec{v}_B = \pm\sqrt{11}\vec{i} + 5\vec{j}$ and $\vec{v}_{AB} = 5\sqrt{3} \pm \sqrt{11}\,\vec{i}$.

$\Rightarrow |\vec{v}_{BA}| = 5\sqrt{3} \pm \sqrt{11}$

Times of intersection are $\frac{10{,}000\text{m}}{5\sqrt{3} + \sqrt{11}}$ and $\frac{10{,}000}{5\sqrt{3} - \sqrt{11}}$

$\frac{10000}{11.48}$ $\frac{10000}{5.347}$

Times of intersection are 12.14 pm and 12.31 pm