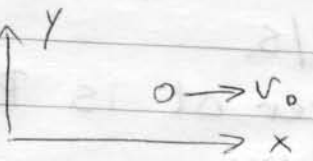
5. Before collision, ball 1 moves with velocity v_1 at x direction



m is the mass of the balls

$v_0 = 1.4\ m/s$

After collision, ball 1 moves with velocity $\vec{v}_1 = v_{1x}\vec{e}_x + v_{1y}\vec{e}_y$

ball 2 moves with velocity $\vec{v}_2 = v_{2x}\vec{e}_x + v_{2y}\vec{e}_y$

Use momentum conservation.

$$\begin{cases} mv_0 = mv_{1x} + mv_{2x} \\ 0 = mv_{1y} + mv_{2y} \end{cases} \Rightarrow \begin{cases} v_0 = v_{1x} + v_{2x} \\ 0 = v_{1y} + v_{2y} \end{cases}$$

Because, v_2 is at an angle 0, then $\left|\frac{v_{2y}}{v_{2x}}\right| = \tan 45^\circ = 1$

$$\begin{cases} v_{1y} = -v_{2y} \\ |v_{2y}| = |v_{2x}| \\ v_0 = v_{1x} + v_{2x} \end{cases} \Rightarrow \begin{cases} v_{1y} = -2v_y \\ v_{2y} = -v \end{cases} \quad \begin{cases} v_{1y} = -v_{2y} \\ v_{2y} = -v_{2x} \\ v_0 = v_{1x} + v_{2x} \end{cases} \Rightarrow v_0 = v_{1x} + v_{1y}$$

$$v_1 = \sqrt{v_{1x}^2 + v_{1y}^2} = \sqrt{v_{1x}^2 + (v_0 - v_{1x})^2}$$

$$\frac{\partial v_1}{\partial v_{1x}} = 0 \Rightarrow v_{1x} = \frac{v_0}{2} \Rightarrow v_{1\,min} = \sqrt{\frac{v_0^2}{4} + \frac{v_0^2}{4}} = \sqrt{\frac{v_0^2}{2}} = \frac{v_0}{\sqrt{2}}$$

$$v_{1\,min} = \frac{v_0}{\sqrt{2}} = \frac{1.4}{\sqrt{2}} \doteq 1.0\ m/s$$