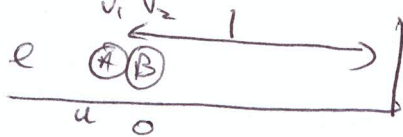


Collision I:



Both masses m

PCM:

$$m u + m(0) = m v_1 + m v_2$$

NLR:

$$\begin{aligned} u &= v_1 + v_2 \\ v_2 - v_1 &= -e(u_2 - u_1) \\ v_2 - v_1 &= -e(0 - u) \\ v_2 - v_1 &= e u \end{aligned} \rightarrow$$

$$2v_2 = u + e u$$

$$v_2 = \frac{u}{2}(1+e)$$

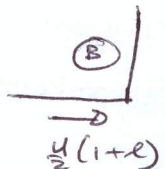
$$\therefore v_1 + \frac{u}{2}(1+e) = u$$

$$v_1 = u - \frac{u}{2} - \frac{u}{2}e$$

$$v_1 = \frac{u}{2} - \frac{u}{2}e$$

$$v_1 = \frac{u}{2}(1-e)$$

Collision II:



NLR \Rightarrow A rebounds with speed $e \frac{u}{2}(1+e)$ in opposite direction.

Let next impact take place x metres from wall.

Collision III



Let t_1 be time for B to reach wall [time between Coll I and Coll II]

In this time B travels 1m at speed $\frac{u}{2}(1+e)$ m/s. (constant speed)

$$\Rightarrow t_1 = \frac{1}{\frac{u}{2}(1+e)} = \frac{2}{u(1+e)}$$

In this time A travels = (speed)(time) = $\frac{u}{2}(1-e) \left(\frac{2}{u(1+e)}\right) = \frac{1-e}{1+e}$ metres.

and the A is $1 - \frac{1-e}{1+e} = \frac{2e}{1+e}$ metres from the wall.

Let t_2 be time for B to travel from wall to meet A again.

Let B travel x metres from wall to meet A, at a speed $\frac{eu}{2}(1+e)$

$$\therefore t_2 = \frac{x}{\frac{eu}{2}(1+e)}$$

But in the same time, t_2 , A will have travelled $\frac{2e}{1+e} - x$ metres towards wall at a speed $\frac{u}{2}(1-e)$

$$\therefore t_2 = \frac{\frac{2e}{1+e} - x}{\frac{u}{2}(1-e)}$$

$$\frac{x}{\frac{eu}{2}(1+e)} = \frac{\frac{2e}{1+e} - x}{\frac{u}{2}(1-e)} \Rightarrow x(1-e) = e(2e - e(1+e))x$$

$$\Rightarrow x - ex + ex + e^2x = 2e^2x$$

\Rightarrow

$$x = \frac{2e^2}{1+e^2} \quad \text{qed. (! Phew!)}$$

$$= \frac{1}{\frac{eu}{2}(1+e)} + \frac{x}{\frac{eu}{2}(1+e)}$$

$$\Rightarrow x = \frac{2e^2}{1+e^2}$$

(checked!)