

5. (a) Two smooth spheres whose masses are  $m$  and  $2m$  move towards each other in a straight line with speeds  $4u$  and  $u$ , respectively.

Show that the spheres will move in opposite directions after the collision if  $e > \frac{1}{5}$ , where  $e$  is the coefficient of restitution.

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(a)

PCM  $m(4u) + 2m(-u) = mv_1 + 2mv_2$

NEL  $v_1 - v_2 = -e(4u + u)$

$$\Rightarrow v_1 = \frac{2u - 10eu}{3} \quad \text{and} \quad v_2 = \frac{2u + 5eu}{3}$$

$$v_2 > 0 \quad \forall e \quad \text{as} \quad 0 \leq e \leq 1$$

$$v_1 < 0 \quad \text{if} \quad 2u - 10eu < 0$$

$$1 < 5e \quad \Rightarrow \quad e > \frac{1}{5}$$

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