

## **STEP II, 2011 Q9**

- 9 Two particles,  $A$  of mass  $2m$  and  $B$  of mass  $m$ , are moving towards each other in a straight line on a smooth horizontal plane, with speeds  $2u$  and  $u$  respectively. They collide directly. Given that the coefficient of restitution between the particles is  $e$ , where  $0 < e \leq 1$ , determine the speeds of the particles after the collision.

After the collision,  $B$  collides directly with a smooth vertical wall, rebounding and then colliding directly with  $A$  for a second time. The coefficient of restitution between  $B$  and the wall is  $f$ , where  $0 < f \leq 1$ . Show that the velocity of  $B$  after its second collision with  $A$  is

$$\frac{2}{3}(1 - e^2)u - \frac{1}{3}(1 - 4e^2)fu$$

towards the wall and that  $B$  moves towards (not away from) the wall for all values of  $e$  and  $f$ .



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