

STEP III, 2005, Q9

- 9 Two particles, A and B, move without friction along a horizontal line which is perpendicular to a vertical wall. The coefficient of restitution between the two particles is e and the coefficient of restitution between particle B and the wall is also e , where $0 < e < 1$. The mass of particle A is $4em$ (with $m > 0$), and the mass of particle B is $(1 - e)^2m$.

Initially, A is moving towards the wall with speed $(1 - e)v$ (where $v > 0$) and B is moving away from the wall and towards A with speed $2ev$. The two particles collide at a distance d from the wall. Find the speeds of A and B after the collision.

When B strikes the wall, it rebounds along the same line. Show that a second collision will take place, at a distance de from the wall.

Deduce that further collisions will take place. Find the distance from the wall at which the n th collision takes place, and show that the times between successive collisions are equal.



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