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6. A particle P of mass m is moving in a straight line with speed v on a smooth horizontal surface. The particle P collides directly with a particle Q of mass km which is moving with speed w, $(w < v)$, along the same straight line and in the same direction as P. The direction of motion of P is unchanged by the collision and, immediately after the collision, the speed of P is w and the speed of Q is $2w$.

The coefficient of restitution between P and Q is $\frac{2}{3}$.

(a) Find the value of k.

(6)

When P and Q collide they are at the point A, which is a distance d from a smooth fixed vertical wall. The wall is perpendicular to the direction of motion of the particles. After the collision with P, particle Q hits the wall and rebounds towards P.

The coefficient of restitution between Q and the wall is $\frac{1}{3}$.

There is a second direct collision between P and Q at the point B.

(b) Find, in terms of d and w, the time taken for P to travel from A to B.

(5)

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