7.



Figure 3

Three particles, P, Q and R, lie at rest on a smooth horizontal surface.

The particles are in a straight line with Q between P and R, as shown in Figure 3.

The mass of P is $2m$, the mass of Q is $3m$ and the mass of R is $5m$.

The coefficient of restitution between each pair of particles is e.

Particle P is projected with speed $2u$ towards Q and they collide.

(a) Show that the speed of Q immediately after the collision is

$$\frac{4u}{5}(e+1)$$

(5)

In the collision, the direction of motion of P is reversed.

(b) Find the full range of possible values of e.

(3)

In the collision, the magnitude of the impulse exerted on Q by P is $\frac{108}{25}mu$

(c) Show that $e = \frac{4}{5}$

(3)

(d) Determine, with clear reasoning, whether there will be a second collision between P and Q.

(6)

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TOTAL FOR PAPER IS 75 MARKS

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