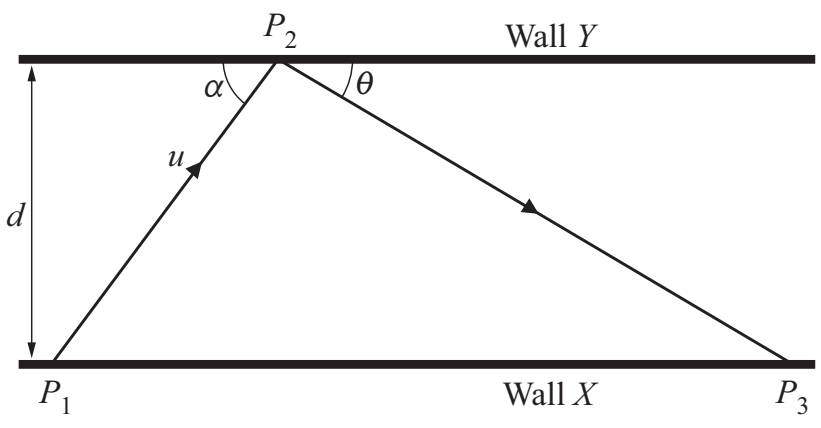
7



X and Y are two fixed smooth vertical walls on a smooth horizontal surface. The walls are parallel and at a distance d apart. The points P_1, P_2 and P_3 all lie on the surface.

A particle Q is projected horizontally from the point P_1 on Wall X with speed u, and moves along the surface. The particle Q strikes Wall Y at the point P_2. Immediately before the collision, the direction of motion of Q makes an angle α with Wall Y, where $\sin\alpha = \frac{4}{5}$. Immediately after the collision, the direction of motion of Q makes an angle θ with Wall Y. The particle Q then strikes Wall X at the point P_3 (see diagram).

The time that it takes Q to travel the distance P_1P_2 is T. The time that it takes Q to travel the distance P_2P_3 is kT.

Find, in terms of k, the coefficient of restitution between Q and Wall Y. [6]

Additional page

If you use the following page to complete the answer to any question, the question number must be clearly shown.