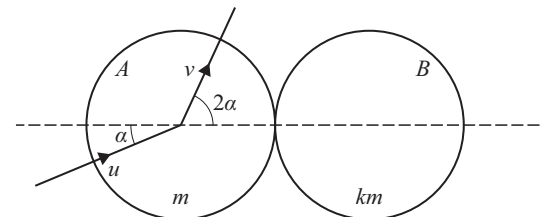


- Two uniform smooth spheres A and B of equal radii have masses $4m$ and m respectively. Sphere B is at rest on a smooth horizontal surface. Sphere A is moving on the surface with speed u and collides directly with sphere B . After the collision, the momentum of A is three times the momentum of B .

Find the value of the coefficient of restitution e .

[4]

- 5 Two uniform smooth spheres, A and B , of equal radii are on a horizontal surface. They have masses of m and km respectively. Sphere A is moving with speed u at an angle α with the line of centres when it collides with sphere B which is stationary. Immediately after the collision, sphere A moves with speed v at an angle 2α with the line of centres (see diagram).



It is given that $\tan \alpha = \frac{3}{4}$.

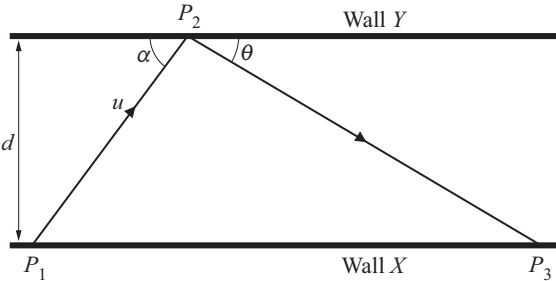
- (a) Find v in terms of u .

[2]

- (b) Find the coefficient of restitution between the spheres in terms of k .

[4]

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]

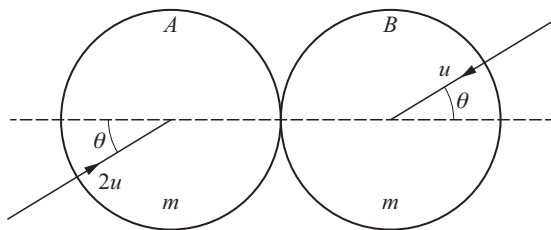
(c) Find the range of possible values of k . [3]

Additional page

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

- (a) Show that $v_B = \frac{6}{5}u$. [3]

(b) Find the value of $\sin(\alpha + \beta)$. [6]



(a) Find an expression for $\tan \theta$ in terms of e . [6]

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As a result of the collision, A moves in a direction which is perpendicular to the line of centres.

(b) Find the value of θ . [2]