



Two uniform smooth spheres  $A$  and  $B$  of equal radii have masses  $m$  and  $\frac{1}{2}m$  respectively. The two spheres are moving on a horizontal surface when they collide. Immediately before the collision, sphere  $A$  is travelling with speed  $u$  and its direction of motion makes an angle  $\alpha$  with the line of centres. Sphere  $B$  is travelling with speed  $2u$  and its direction of motion makes an angle  $\beta$  with the line of centres (see diagram). The coefficient of restitution between the spheres is  $\frac{5}{8}$  and  $\alpha + \beta = 90^\circ$ .

- (a) Find the component of the velocity of  $B$  parallel to the line of centres after the collision, giving your answer in terms of  $u$  and  $\alpha$ . [4]

The direction of motion of  $B$  after the collision is parallel to the direction of motion of  $A$  before the collision.

- (b) Find the value of  $\tan \alpha$ . [5]