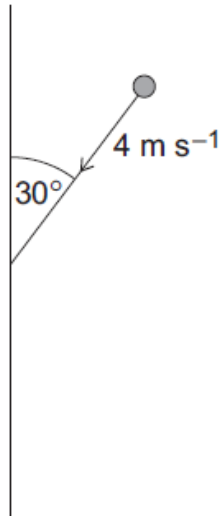


AQA – Momentum and collisions – A2 Further Mathematics Mechanics**1. June/2020/Paper_3/No.5**

A ball, of mass 0.3 kg, is moving on a smooth horizontal surface.

The ball collides with a smooth fixed vertical wall and rebounds.

Before the ball hits the wall, the ball is moving at 4 m s^{-1} at an angle of 30° to the wall as shown in the diagram.



The magnitude of the force, F newtons, exerted on the ball by the wall at time t seconds is modelled by

$$F = kt^2(0.1 - t)^2 \quad \text{for } 0 \leq t \leq 0.1$$

where k is a constant.

The ball is in contact with the wall for 0.1 seconds.

- (a) Show that the impulse exerted on the ball by the wall while they are in contact has magnitude $\frac{k}{3\,000\,000}$

Fully justify your answer.

[4 marks]

(b) Explain why $1\,800\,000 < k \leq 3\,600\,000$

Fully justify your answer.

[5 marks]

(c) Given that $k = 2\,400\,000$

Find the speed of the ball after the collision with the wall.

[4 marks]

2. June/2019/Paper_3/No.6

A ball moving on a smooth horizontal surface collides with a fixed vertical wall. Before the collision, the ball moves with speed 7 m s^{-1} and at an angle of 40° to the wall.

After the collision, the ball moves with speed 5 m s^{-1} and at an angle of 26° to the wall.

Model the ball as a particle.

- (a) Find the coefficient of restitution between the ball and the wall, giving your answer correct to two significant figures.

[3 marks]

(b) Determine whether or not the wall is smooth.

Fully justify your answer.

[3 marks]
