

Impulse and Momentum – 2022 GCE Mechanics Further Math A Y543**1. June/2022/Paper_Y543/01/No.3**

A particle P of mass 6 kg moves in a straight line under the action of a single force of magnitude $F\text{ N}$ which acts in the direction of motion of P .

At time t seconds, where $t \geq 0$, F is given by $F = \frac{1}{5 - 4e^{-t^2}}$.

When $t = 0$, the speed of P is 1.9 m s^{-1} .

(a) Find the impulse of the force over the period $0 \leq t \leq 2$. [2]

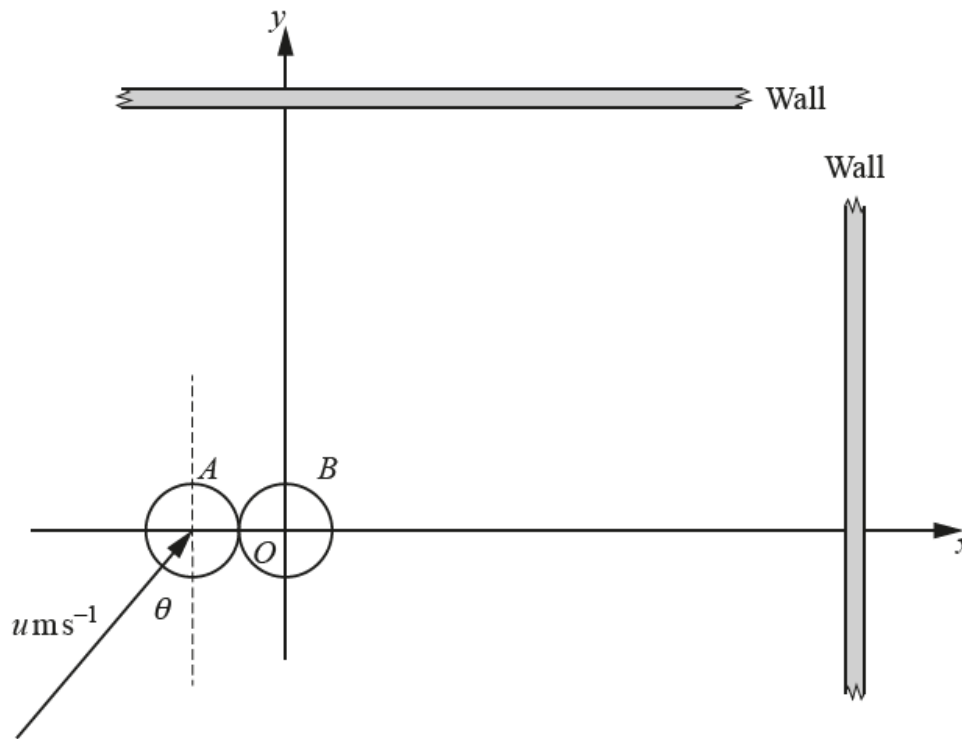
(b) Find the speed of P at the instant when $t = 2$. [2]

(c) Find the work done by the force on P over the period $0 \leq t \leq 2$. [2]

2. June/2022/Paper_Y543/01/No.8

Two smooth circular discs, A and B , have equal radii and are free to move on a smooth horizontal plane. The masses of A and B are 1 kg and $m\text{ kg}$ respectively. B is initially placed at rest with its centre at the origin, O . A is projected towards B with a velocity of $u\text{ m s}^{-1}$ at an angle of θ to the negative y -axis where $\tan \theta = \frac{5}{2}$. At the instant of collision the line joining their centres lies on the x -axis.

There are two straight vertical walls on the plane. One is perpendicular to the x -axis and the other is perpendicular to the y -axis. The walls are an equal distance from O (see diagram).



After A and B have collided with each other, each of them goes on to collide with a wall. Each then rebounds and they collide again at the same place as their first collision, with disc B again at O .

The coefficient of restitution between A and B is denoted by e . The coefficient of restitution between A and the wall that it collides with is also e while the coefficient of restitution between B and the wall that it collides with is $\frac{5}{9}e$.

It is assumed that any resistance to the motion of A and B may be ignored.

- Explain why it must be the case that the collision between A and the wall that it collides with is not inelastic. [1]
- Show that $e = \frac{1}{m}$. [4]
- Show that $m = \frac{5}{3}$. [7]
- State **one** limitation of the model used. [1]