

Write your name here

Surname

Other names

Pearson Edexcel
Level 3 GCE

Centre Number

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Candidate Number

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Further Mathematics

Advanced
Further Mathematics Option 1
Paper 3: Further Mechanics 1
Further Mathematics Option 2
Paper 4: Further Mechanics 1

Sample Assessment Material for first teaching September 2017

Time: 1 hour 30 minutes

Paper Reference

9FM0/3C
9FM0/4C

You must have:

Mathematical Formulae and Statistical Tables, calculator

Total Marks

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Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for algebraic manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 8 questions in this question paper. The total mark for this paper is 75.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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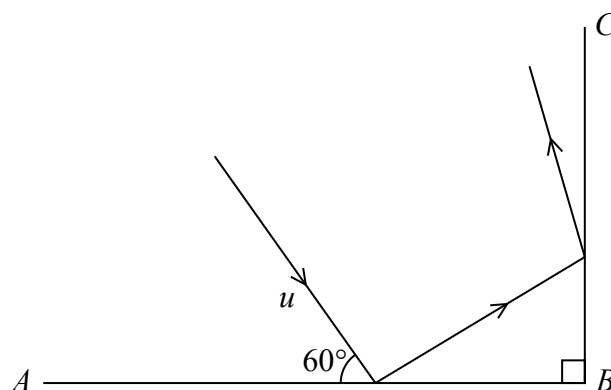


Figure 1

Figure 1 represents the plan view of part of a horizontal floor, where AB and BC are perpendicular vertical walls.

The floor and the walls are modelled as smooth.

A ball is projected along the floor towards AB with speed $u \text{ m s}^{-1}$ on a path at an angle of 60° to AB . The ball hits AB and then hits BC .

The ball is modelled as a particle.

The coefficient of restitution between the ball and wall AB is $\frac{1}{\sqrt{3}}$

The coefficient of restitution between the ball and wall BC is $\sqrt{\frac{2}{5}}$

(a) Show that, using this model, the final kinetic energy of the ball is 35% of the initial kinetic energy of the ball.

(8)

(b) In reality the floor and the walls may not be smooth. What effect will the model have had on the calculation of the percentage of kinetic energy remaining?

(1)

5. A car of mass 600 kg is moving along a straight horizontal road.

At the instant when the speed of the car is $v \text{ m s}^{-1}$, the resistance to the motion of the car is modelled as a force of magnitude $(200 + 2v) \text{ N}$.

The engine of the car is working at a constant rate of 12 kW.

- (a) Find the acceleration of the car at the instant when $v = 20$

(4)

Later on the car is moving up a straight road inclined at an angle θ to the horizontal,

$$\text{where } \sin \theta = \frac{1}{14}$$

At the instant when the speed of the car is $v \text{ m s}^{-1}$, the resistance to the motion of the car from non-gravitational forces is modelled as a force of magnitude $(200 + 2v) \text{ N}$.

The engine is again working at a constant rate of 12 kW.

At the instant when the car has speed $w \text{ m s}^{-1}$, the car is decelerating at 0.05 m s^{-2} .

- (b) Find the value of w .

(5)

Question 7 continued

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(Total for Question 7 is 14 marks)

8. A particle P of mass $2m$ and a particle Q of mass $5m$ are moving along the same straight line on a smooth horizontal plane.

They are moving in opposite directions towards each other and collide directly.

Immediately before the collision the speed of P is $2u$ and the speed of Q is u .

The direction of motion of Q is reversed by the collision.

The coefficient of restitution between P and Q is e .

- (a) Find the range of possible values of e .

(8)

Given that $e = \frac{1}{3}$

- (b) show that the kinetic energy lost in the collision is $\frac{40mu^2}{7}$.

(5)

- (c) Without doing any further calculation, state how the amount of kinetic energy lost in the collision would change if $e > \frac{1}{3}$

(1)

