

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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## Pearson Edexcel Level 3 GCE

Time 1 hour 30 minutes

Paper  
reference

**9FM0/3C**

### Further Mathematics

Advanced

**PAPER 3C: Further Mechanics 1**

**You must have:**

Mathematical Formulae and Statistical Tables (Green), calculator

Total Marks

**Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for symbolic 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.
- Unless otherwise indicated, whenever a numerical value of  $g$  is required, take  $g = 9.8 \text{ m s}^{-2}$  and give your answer to either 2 significant figures or 3 significant figures.

#### 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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3.

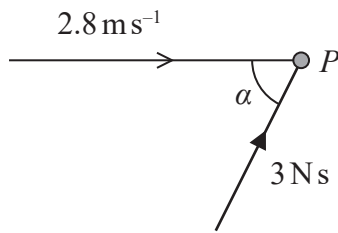


Figure 2

A particle  $P$  of mass  $0.5 \text{ kg}$  is moving in a straight line with speed  $2.8 \text{ ms}^{-1}$  when it receives an impulse of magnitude  $3 \text{ N s}$ .

The angle between the direction of motion of  $P$  immediately before receiving the impulse and the line of action of the impulse is  $\alpha$ , where  $\tan \alpha = \frac{4}{3}$ , as shown in Figure 2.

Find the speed of  $P$  immediately after receiving the impulse.

(5)

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6.

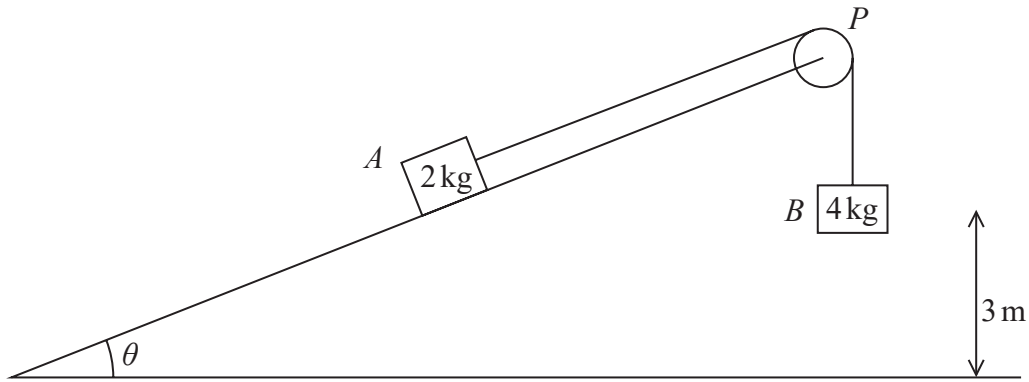


Figure 4

Two blocks,  $A$  and  $B$ , of masses 2 kg and 4 kg respectively are attached to the ends of a light inextensible string.

Initially  $A$  is held on a fixed rough plane. The plane is inclined to horizontal ground at an angle  $\theta$ , where  $\tan \theta = \frac{3}{4}$

The string passes over a small smooth light pulley  $P$  that is fixed at the top of the plane. The part of the string from  $A$  to  $P$  is parallel to a line of greatest slope of the plane.

Block  $A$  is held on the plane with the distance  $AP$  greater than 3 m.

Block  $B$  hangs freely below  $P$  at a distance of 3 m above the ground, as shown in Figure 4.

The coefficient of friction between  $A$  and the plane is  $\mu$

Block  $A$  is released from rest with the string taut.

By modelling the blocks as particles,

- (a) find the potential energy lost by the whole system as a result of  $B$  falling 3 m. (3)

Given that the speed of  $B$  at the instant it hits the ground is  $4.5 \text{ m s}^{-1}$  and ignoring air resistance,

- (b) use the work-energy principle to find the value of  $\mu$  (6)

After  $B$  hits the ground,  $A$  continues to move up the plane but does not reach the pulley in the subsequent motion.

Block  $A$  comes to instantaneous rest after moving a total distance of  $(3 + d)$  m from its point of release.

Ignoring air resistance,

- (c) use the work-energy principle to find the value of  $d$  (4)



















8.



Figure 5

Figure 5 represents the plan view of part of a smooth horizontal floor, where  $RS$  and  $ST$  are smooth fixed vertical walls. The vector  $\overrightarrow{RS}$  is in the direction of  $\mathbf{i}$  and the vector  $\overrightarrow{ST}$  is in the direction of  $(2\mathbf{i} + \mathbf{j})$ .

A small ball  $B$  is projected across the floor towards  $RS$ . Immediately before the impact with  $RS$ , the velocity of  $B$  is  $(6\mathbf{i} - 8\mathbf{j})\text{ m s}^{-1}$ . The ball bounces off  $RS$  and then hits  $ST$ .

The ball is modelled as a particle.

Given that the coefficient of restitution between  $B$  and  $RS$  is  $e$ ,

(a) find the full range of possible values of  $e$ .

(3)

It is now given that  $e = \frac{1}{4}$  and that the coefficient of restitution between  $B$  and  $ST$  is  $\frac{1}{2}$

(b) Find, in terms of  $\mathbf{i}$  and  $\mathbf{j}$ , the velocity of  $B$  immediately after its impact with  $ST$ .

(7)









