

Please check the examination details below before entering your candidate information

Candidate surname					Other names									
<b>Pearson Edexcel</b>					Centre Number					Candidate Number				
<b>Level 3 GCE</b>					<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>					<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>				
					Paper reference					<b>8FM0/26</b>				
<b>Further Mathematics</b>														
<b>Advanced Subsidiary</b>														
<b>Further Mathematics options</b>														
<b>26: Further Mechanics 2</b>														
<b>(Part of option J)</b>														
<b>You must have:</b>										Total Marks				
Mathematical Formulae and Statistical Tables (Green), calculator														

**Candidates may use any calculator allowed by Pearson regulations. Calculators must not have the facility for symbolic algebra 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 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.
- The total mark for this part of the examination is 40. There are 4 questions.
- 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.
- Good luck with your examination.

Turn over ►

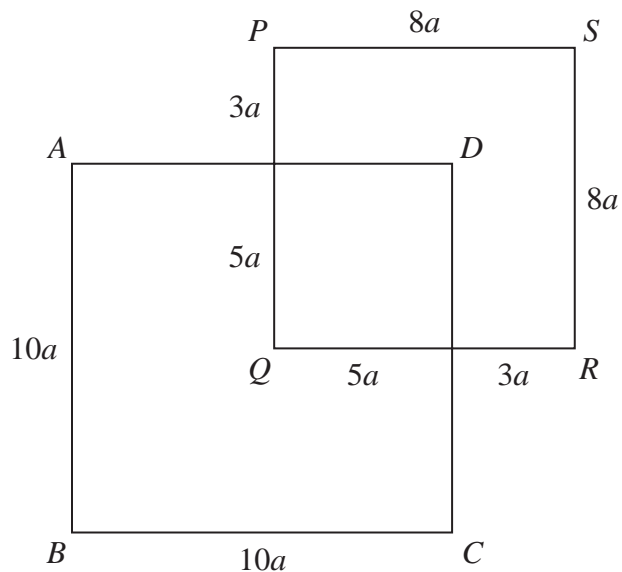
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1.

**Figure 1**

A uniform rod of length  $72a$  is cut into pieces. The pieces are used to make two rigid squares,  $ABCD$  and  $PQRS$ , with sides of length  $10a$  and  $8a$  respectively. The two squares are joined to form the rigid framework shown in Figure 1.

The squares both lie in the same plane with the rod  $AB$  parallel to the rod  $PQ$ .

Given that

- $AD$  cuts  $PQ$  in the ratio  $3:5$
- $DC$  cuts  $QR$  in the ratio  $5:3$

(a) explain why the centre of mass of square  $ABCD$  is at  $Q$ .

**(1)**

(b) Find the distance of the centre of mass of the framework from  $B$ .

**(5)**


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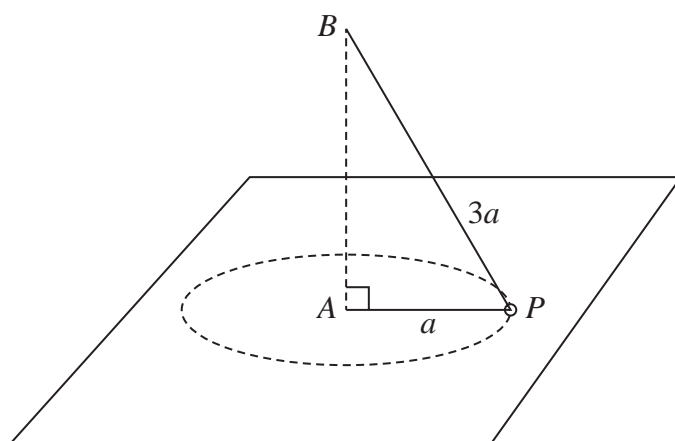
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2.



**Figure 2**

A small smooth ring  $P$ , of mass  $m$ , is threaded onto a light inextensible string of length  $4a$ . One end of the string is attached to a fixed point  $A$  on a smooth horizontal table. The other end of the string is attached to a fixed point  $B$  which is vertically above  $A$ . The ring moves in a horizontal circle with centre  $A$  and radius  $a$ , as shown in Figure 2.

The ring moves with constant angular speed  $\sqrt{\frac{2g}{3a}}$  about  $AB$ .

The string remains taut throughout the motion.

- (a) Find, in terms of  $m$  and  $g$ , the magnitude of the normal reaction between  $P$  and the table. (6)

The angular speed of  $P$  is now gradually increased.

- (b) Find, in terms of  $a$  and  $g$ , the angular speed of  $P$  at the instant when it loses contact with the table. (3)
- (c) Explain how you have used the fact that  $P$  is smooth. (1)

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### Question 2 continued

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3.

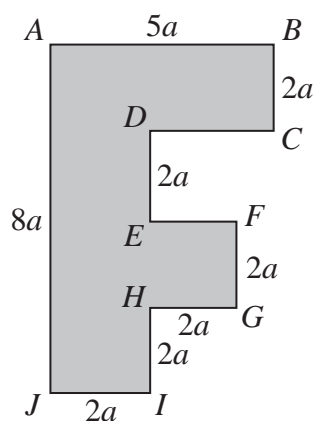


Figure 3

The uniform lamina  $ABCDEFGHJI$  is shown in Figure 3.

The lamina has  $AJ = 8a$ ,  $AB = 5a$  and  $BC = DE = EF = FG = GH = HI = IJ = 2a$ .

All the corners are right angles.

- (a) Show that the distance of the centre of mass of the lamina from  $AJ$  is  $\frac{49}{26}a$  (5)

A light inextensible rope is attached to the lamina at  $A$  and another light inextensible rope is attached to the lamina at  $B$ . The lamina hangs in equilibrium with both ropes vertical and  $AB$  horizontal. The weight of the lamina is  $W$ .

- (b) Find, in terms of  $W$ , the tension in the rope attached to the lamina at  $B$ . (3)

The rope attached to  $B$  breaks and subsequently the lamina hangs freely in equilibrium, suspended from  $A$ .

- (c) Find the size of the angle between  $AJ$  and the downward vertical. (5)





**Question 3 continued**

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**Question 3 continued**

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4. A particle  $P$  moves on the  $x$ -axis. At time  $t$  seconds,  $t \geq 0$ ,  $P$  is  $x$  metres from the origin  $O$  and moving with velocity  $v \text{ m s}^{-1}$  in the direction of  $x$  increasing, where

$$v = 5 \sin 2t$$

When  $t = 0$ ,  $x = 1$  and  $P$  is at rest.

- (a) Find the magnitude and direction of the acceleration of  $P$  at the instant when  $P$  is next at rest. (4)
- (b) Show that  $1 \leq x \leq 6$  (4)
- (c) Find the total time, in the first  $4\pi$  seconds of the motion, for which  $P$  is more than 3 metres from  $O$  (3)

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