

Write your name here

Surname

Other names

**Pearson Edexcel**  
**International**  
**Advanced Level**

Centre Number

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Candidate Number

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# Mechanics M2

## Advanced/Advanced Subsidiary

Friday 24 January 2014 – Afternoon

**Time: 1 hour 30 minutes**

Paper Reference

**WME02/01**

**You must have:**

Mathematical Formulae and Statistical Tables (Blue)

Total Marks

**Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. 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). Coloured pencils and highlighter pens must not be used.
- **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.
- Whenever a numerical value of  $g$  is required, take  $g = 9.8 \text{ m s}^{-2}$ , and give your answer to either two significant figures or three significant figures.
- When a calculator is used, the answer should be given to an appropriate degree of accuracy.

### Information

- 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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P 4 3 0 6 9 A 0 1 2 8

**PEARSON**

(5)

(3)

Question 1 continued

Handwriting practice lines for Question 1 continued.

Q1

(Total 8 marks)





This image shows a full page of blank, lined paper. It features approximately 28 horizontal blue or grey lines spaced evenly apart, typical of standard notebook paper. The lines extend across the entire width of the page, leaving small margins at the top and bottom. There are no vertical lines, text, or other markings on the page.

### Question 2 continued

[illegible]

**(Total 11 marks)**

**Q2**







This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal grey lines across its entire width, providing a guide for handwriting or typing. The paper itself is a clean, off-white color.

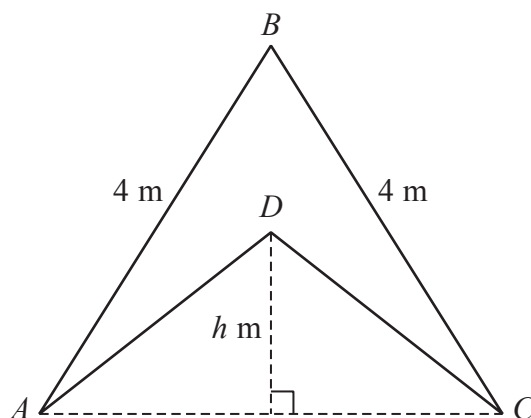
[illegible]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

**(Total 12 marks)**

**Q3**





A uniform lamina  $ABCD$  is formed by removing the isosceles triangle  $ADC$  of height  $h$  metres, where  $h < 2\sqrt{3}$ , from a uniform lamina  $ABC$  in the shape of an equilateral triangle of side 4 m, as shown in Figure 1. The centre of mass of  $ABCD$  is at  $D$ .

- The weight of the lamina  $ABCD$  is  $W$  newtons. The lamina is freely suspended from  $A$ . A horizontal force of magnitude  $F$  newtons is applied at  $B$  so that the lamina is in equilibrium with  $AB$  vertical. The horizontal force acts in the vertical plane containing the lamina.

- (b) Find  $F$  in terms of  $W$ . (4)

[illegible]

[illegible]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 4 continued

Handwriting practice lines for Question 4 continued.

(Total 11 marks)

Q4



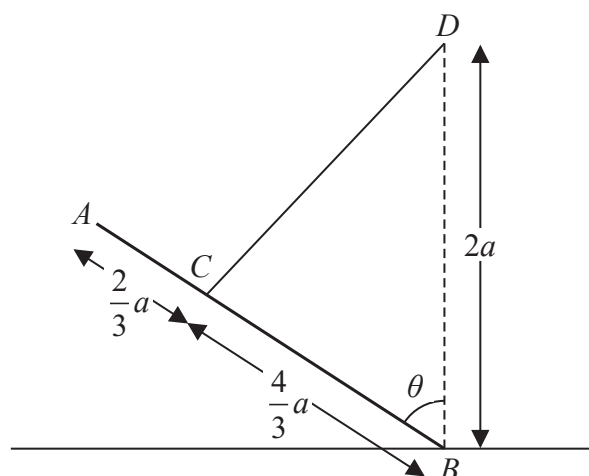


Figure 2 shows a uniform rod  $AB$ , of mass  $m$  and length  $2a$ , with the end  $B$  resting on rough horizontal ground. The rod is held in equilibrium at an angle  $\theta$  to the vertical by a light inextensible string. One end of the string is attached to the rod at the point  $C$ , where  $AC = \frac{2}{3}a$ . The other end of the string is attached to the point  $D$ , which is vertically above  $B$ , where  $BD = 2a$ .

- The rod is in limiting equilibrium when  $\tan \theta = \frac{4}{3}$

- (c) Find the coefficient of friction between the rod and the ground. (3)





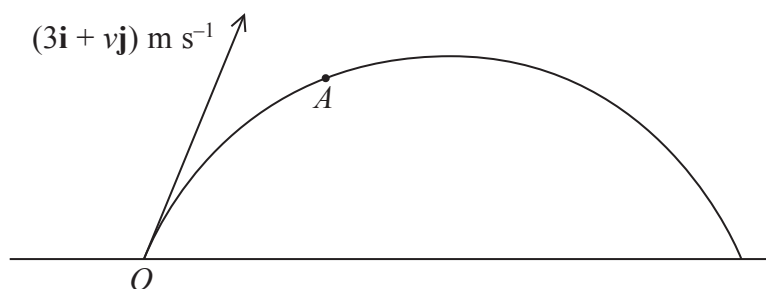
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[illegible]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

**(Total 11 marks)**

**Q5**



The point  $O$  is a fixed point on a horizontal plane. A ball is projected from  $O$  with velocity  $(3\mathbf{i} + v\mathbf{j}) \text{ m s}^{-1}$ ,  $v > 3$ . The ball moves freely under gravity and passes through the point  $A$  before reaching its maximum height above the horizontal plane, as shown in Figure 3.

The ball passes through  $A$  at time  $\frac{15}{49}$  s after projection. The initial kinetic energy of the ball is  $E$  joules. When the ball is at  $A$  it has kinetic energy  $\frac{1}{2}E$  joules.

- (a) Find the value of  $v$ .

At another point  $B$  on the path of the ball the kinetic energy is also  $\frac{1}{2}E$  joules.

The ball passes through  $B$  at time  $T$  seconds after projection.

- (b) Find the value of  $T$ .

(3)

[illegible]

This image shows a single page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There is no text or other markings on the paper.

**Q6**

- (ii) the speed of  $B$  immediately after the collision.

Given that the direction of motion of  $A$  is reversed in the collision between  $A$  and  $B$ , and that there is no collision between  $B$  and  $C$ ,

- (4)

[illegible]



[illegible]

[illegible]

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**Question 7 continued**

Handwriting practice lines for Question 7 continued.

(Total 11 marks)

**Q7**

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**TOTAL FOR PAPER: 75 MARKS**

**END**

