Pearson Edexcel International Advanced Level

Thursday 23 October 2025

Afternoon (Time: 1 hour 30 minutes)

Paper reference **WME02/01A**

Mathematics

International Advanced Subsidiary/Advanced Level
Mechanics M2
Question Paper

You must have:
Answer book (sent separately).
Do not return this question paper with the answer book.

Turn over ▶

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M:1/1/1/1/

P 8 7 4 3 9 A

Pearson

1 A particle of mass 4 kg is moving with velocity $(2\mathbf{i} + 3\mathbf{j})\,\text{m s}^{-1}$ when it receives an impulse of $(7\mathbf{i} - 5\mathbf{j})\,\text{N s}$.

Find the speed of the particle immediately after receiving the impulse.

(5)

(Total for Question 1 is 5 marks)

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2 Three particles of masses m, $4m$ and km are placed at the points whose coordinates are $(-3, 2)$, $(4, 3)$ and $(6, -4)$ respectively.

The centre of mass of the three particles is at the point with coordinates $(c, 0)$.

Find

(a) the value of k,

(3)

(b) the value of c.

(3)

(Total for Question 2 is 6 marks)

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3. **In this question you must show all stages of your working.**
Solutions relying on calculator technology are not acceptable.

At time t seconds ($t \geqslant 0$) a particle P has position vector $\mathbf{r}$ metres, with respect to a fixed origin O, where

$$\mathbf{r} = (16t - 3t^3)\mathbf{i} + (t^3 - t^2 + 2)\mathbf{j}$$

Find

(a) the velocity of P at the instant when it is moving parallel to the vector $\mathbf{j}$,

(5)

(b) the magnitude of the acceleration of P when $t = 4$

(4)

(Total for Question 3 is 9 marks)

4.

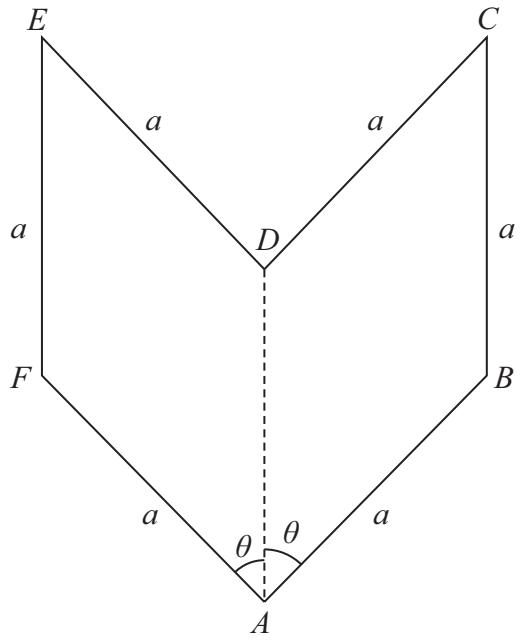

Figure 1

The uniform plane lamina $ABCDEF$ shown in Figure 1 is made from two identical rhombuses.

Each rhombus has sides of length a and angle BAD = angle $DAF = \theta$.

The centre of mass of the lamina is $0.9a$ from A.

(a) Show that $\cos\theta = 0.8$

(5)

The weight of the lamina is W.

A particle of weight kW is fixed to the lamina at the point A.

The lamina is freely suspended from B and hangs in equilibrium with DA horizontal.

(b) Find the value of k.

(4)

(Total for Question 4 is 9 marks)

5

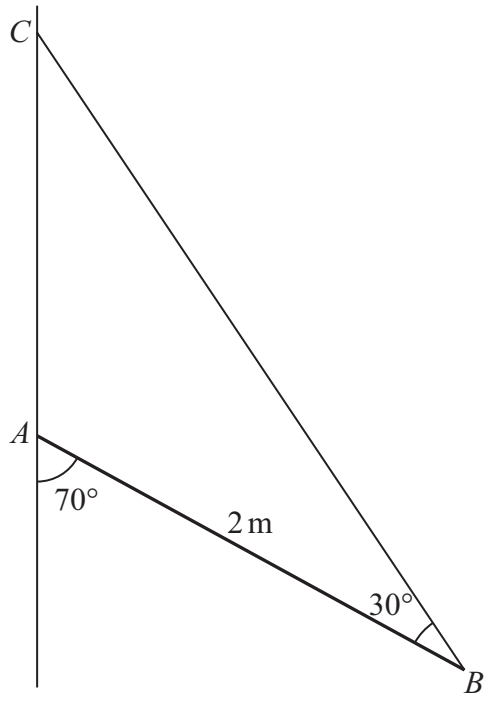

Figure 2

A uniform rod AB has mass 6 kg and length 2 m. The end A of the rod rests against a rough vertical wall.

One end of a light string is attached to the rod at B. The other end of the string is attached to the wall at C, which is vertically above A.

The angle between the rod and the string is 30° and the angle between the rod and the wall is 70°, as shown in Figure 2.

The rod is in a vertical plane perpendicular to the wall and rests in limiting equilibrium.

Find

(a) the tension in the string,

(4)

(b) the coefficient of friction between the rod and the wall,

(5)

(c) the direction of the force exerted on the rod by the wall at A.

(2)

(Total for Question 5 is 11 marks)

6. **In this question you must show all stages of your working.**
Solutions relying on calculator technology are not acceptable.

A particle P moves on the x-axis.

At time t seconds, $t \geqslant 0$

- the acceleration of P is $(2t - 3)\,\text{m s}^{-2}$ in the positive x direction
- the velocity of P is $v\,\text{m s}^{-1}$ in the positive x direction

When $t = 3$, $v = 2$

(a) Find v in terms of t.

(4)

The particle first comes to instantaneous rest at the point A and then comes to instantaneous rest again at the point B.

(b) Find the distance AB.

(6)

(Total for Question 6 is 10 marks)

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7. A particle P is projected from a fixed point A with speed $12\,\text{m s}^{-1}$ at an angle α above the horizontal and moves freely under gravity.

As P passes through the point B on its path, P is moving with speed $8\,\text{m s}^{-1}$ at an angle β below the horizontal.

(a) By using the principle of the conservation of mechanical energy, find the vertical distance between A and B.

(4)

Particle P takes 1.5 seconds to travel from A to B.

(b) Find the size of angle α.

(3)

(c) Find the size of angle β.

(3)

(d) Find the length of time for which the speed of P is less than $8\,\text{m s}^{-1}$.

(4)

(Total for Question 7 is 14 marks)

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8. Three particles A, B and C, each of mass m, lie at rest in a straight line L on a smooth horizontal surface, with B **between** A and C.

Particles A and B are projected directly **towards** each other with speeds $5u$ and $4u$ respectively.

At the same instant, particle C is projected directly **away** from B with speed $3u$.

In the subsequent motion, A, B and C move along L.

Particles A and B collide directly.

The coefficient of restitution between A and B is e.

(a) Find

(i) the speed of A immediately after the collision,

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

(7)

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,

(b) find the set of possible values of e.

(4)

(Total for Question 8 is 11 marks)

TOTAL FOR PAPER IS 75 MARKS

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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

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Mathematics

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Mechanics M2
Answer Book

You must have: Question paper (sent separately)
Mathematical Formulae and Statistical Tables (Yellow), calculator

Total Marks

Candidates may use any calculator permitted 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.
- Whenever a numerical value of g is required, take $g = 9.8$ 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.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over ▶

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Question 1

Write the answer to Question 1 on these 2 pages

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Question 1 continued

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(Total for Question 1 is 5 marks)

Question 2

Write the answer to Question 2 on these 2 pages

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Question 2 continued

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(Total for Question 2 is 6 marks)

Question 3

Write the answer to Question 3 on these 4 pages

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Question 3 continued

Question 3 continued

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Question 3 continued

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(Total for Question 3 is 9 marks)

Question 4

Write the answer to Question 4 on these 4 pages

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Question 4 continued

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Question 4 continued

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(Total for Question 4 is 9 marks)

Question 5

Write the answer to Question 5 on these 4 pages

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Question 5 continued

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Question 5 continued

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(Total for Question 5 is 11 marks)

Question 6

Write the answer to Question 6 on these 4 pages

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Question 6 continued

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Question 6 continued

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(Total for Question 6 is 10 marks)

Question 7

Write the answer to Question 7 on these 4 pages

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Question 7 continued

Question 7 continued

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Question 7 continued

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(Total for Question 7 is 14 marks)

Question 8

Write the answer to Question 8 on these 7 pages

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Question 8 continued

Question 8 continued

(Total for Question 8 is 11 marks)

TOTAL FOR PAPER IS 75 MARKS

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