Pearson Edexcel International Advanced Level

Thursday 15 January 2026

Morning (Time: 1 hour 30 minutes)

Paper reference **WME02/01A**

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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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Pearson

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

Immediately after the impulse is applied, P has velocity $(2\mathbf{i} - 3\mathbf{j})\,\text{m s}^{-1}$.

(a) Find the magnitude of the impulse.

(5)

(b) Find the angle between the direction of the impulse and the direction of motion of P immediately before the impulse is applied.

(3)

(Total for Question 1 is 8 marks)

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2. A cyclist and his bicycle have a total mass of 75 kg. The cyclist is moving **up** a straight road inclined at an angle θ to the horizontal, where $\sin\theta = \frac{1}{21}$.

The non-gravitational resistance to motion is modelled as a constant force of magnitude R newtons.

The cyclist is working at a constant rate of 280 W and moving at a constant speed of $2\,\text{m s}^{-1}$.

(a) Find the value of R.

(4)

Later the cyclist cycles **down** the same road on the same bicycle.

He is again working at a constant rate of 280 W and the resistance to motion is now modelled as a constant force of magnitude 60 N.

(b) Find the acceleration of the cyclist at the instant when his speed is $3.5\,\text{m s}^{-1}$.

(4)

(Total for Question 2 is 8 marks)

3.

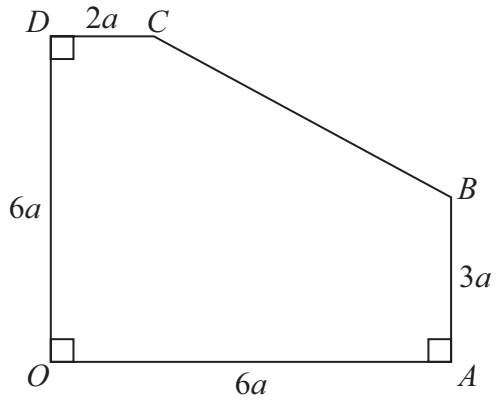

Figure 1

The uniform **lamina** $OABCD$ is shown in Figure 1, with $OA = 6a$, $AB = 3a$, $CD = 2a$ and $DO = 6a$ and with right angles at O, A and D.

(a) Find the distance of the centre of mass of the lamina

(i) from OD,

(ii) from OA.

(6)

The lamina is suspended from C and hangs freely in equilibrium with CB inclined at an angle α to the vertical.

(b) Find, to the nearest degree, the size of the angle α.

(4)

(Total for Question 3 is 10 marks)

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4. **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

$$\mathbf{r} = \left(t^3 - \frac{9}{2}t^2 - 24t\right)\mathbf{i} + \left(-t^3 + 3t^2 + 12t\right)\mathbf{j}$$

At time T seconds, P is moving in a direction parallel to the vector $-\mathbf{i} - \mathbf{j}$

Find

(a) the value of T,

(5)

(b) the magnitude of the acceleration of P at the instant when $t = T$.

(5)

(Total for Question 4 is 10 marks)

5.

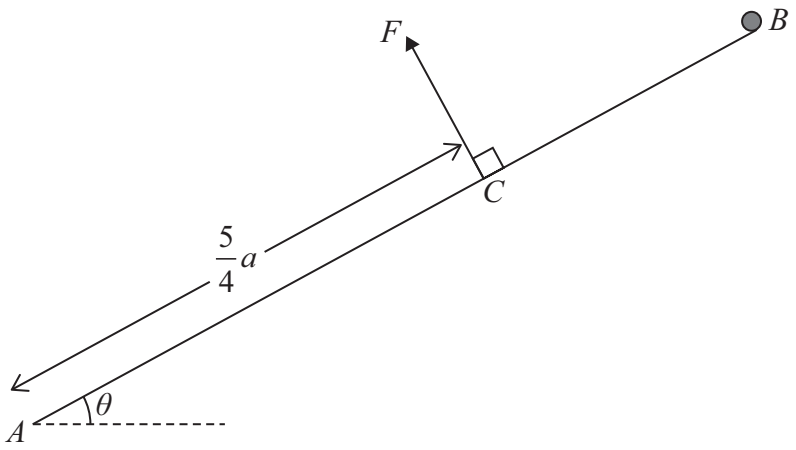

Figure 2

A uniform rod AB, of mass m and length $2a$, is freely hinged to a fixed point A.

A particle of mass km is fixed to the rod at B.

The rod is held in equilibrium, at an angle θ to the horizontal, by a force of magnitude F acting at the point C on the rod, where $AC = \frac{5}{4}a$, as shown in Figure 2.

The line of action of the force at C is at right angles to AB and is in the vertical plane containing AB.

Given that $\tan\theta = \frac{3}{4}$

(a) show that $F = \frac{16}{25}mg(1 + 2k)$

(4)

(b) find, in terms of m, g and k,

(i) the horizontal component of the force exerted by the hinge on the rod at A,

(ii) the vertical component of the force exerted by the hinge on the rod at A.

(5)

Given also that the force acting on the rod at A acts at 45° above the horizontal,

(c) find the value of k.

(3)

(Total for Question 5 is 12 marks)

6. Two particles A and B, of mass m and $2m$ respectively, are moving in the same direction along the same straight line on a smooth horizontal surface, with B in front of A.

Particle A has speed $3\,\text{m s}^{-1}$ and particle B has speed $2\,\text{m s}^{-1}$.

Particle A collides directly with particle B.

The coefficient of restitution between A and B is $\frac{2}{3}$.

The direction of motion of both particles is **not** changed by the collision.

Immediately after the collision, A has speed $v\,\text{m s}^{-1}$ and B has speed $w\,\text{m s}^{-1}$.

(a) (i) Show that $w = \frac{23}{9}$

(ii) Find the value of v.

(7)

When A and B collide they are 3 m from a smooth vertical wall which is perpendicular to their direction of motion.

After the collision with A, particle B hits the wall and rebounds.

The coefficient of restitution between B and the wall is $\frac{1}{2}$

There is a second collision between A and B at a point d m from the wall.

(b) Find the value of d.

(7)

(Total for Question 6 is 14 marks)

7. [*In this question, the unit vectors* **i** *and* **j** *are in a vertical plane,* **i** *being horizontal and* **j** *being vertically upwards.*]

At time $t = 0$, a particle P is projected with velocity $(4\mathbf{i} + 9\mathbf{j})\,\text{m s}^{-1}$ from a fixed point O on horizontal ground.

The particle moves freely under gravity.

When P is at the point H on its path, P is at its greatest height above the ground.

(a) Find the time taken by P to reach H.

(2)

At the point A on its path, the position vector of P relative to O is $(k\mathbf{i} + k\mathbf{j})\,\text{m}$, where k is a positive constant.

(b) Find the value of k.

(4)

(c) Find, in terms of k, the position vector of the other point on the path of P which is at the same vertical height above the ground as the point A.

(3)

At time T seconds the particle is at the point B and is moving perpendicular to $(4\mathbf{i} + 9\mathbf{j})$

(d) Find the value of T.

(4)

(Total for Question 7 is 13 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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Paper reference **WME02/01A**

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Mathematics

International Advanced Subsidiary/Advanced Level
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 $g = 9.8\,\text{m}\,\text{s}^{-2}$ 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 7 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.

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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 8 marks)

Question 2

Write the answer to Question 2 on these 4 pages

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DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 2 continued

Question 2 continued

DO NOT WRITE IN THIS AREA

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Question 2 continued

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(Total for Question 2 is 8 marks)

Question 3

Write the answer to Question 3 on these 4 pages

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Question 3 continued

Question 3 continued

Question 3 continued

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(Total for Question 3 is 10 marks)

Question 4

Write the answer to Question 4 on these 4 pages

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Question 4 continued

Question 4 continued

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Question 4 continued

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(Total for Question 4 is 10 marks)

Question 5

Write the answer to Question 5 on these 4 pages

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Question 5 continued

Question 5 continued

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Question 5 continued

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(Total for Question 5 is 12 marks)

Question 6

Write the answer to Question 6 on these 4 pages

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Question 6 continued

Question 6 continued

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Question 6 continued

This is the end of Question 6 answer space. Please turn the page for Question 7 answer space.

(Total for Question 6 is 14 marks)

Question 7

Write the answer to Question 7 on these 5 pages

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Question 7 continued

Question 7 continued

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Question 7 continued

Question 7 continued

(Total for Question 7 is 13 marks)

TOTAL FOR PAPER IS 75 MARKS

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