Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Thursday 15 January 2026

Morning (Time: 1 hour 30 minutes)

Paper reference **WME02/01**

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Mathematics

International Advanced Subsidiary/Advanced Level
Mechanics M2

You must have:
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.

Turn over ▶

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1. A van of mass 1200 kg is moving **up** a straight road that is inclined at an angle θ to the horizontal, where $\sin\theta = \frac{1}{14}$

The engine of the van is working at a constant rate of 20 000 W.

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

At the instant when the acceleration of the van is $0.75\,\text{m s}^{-2}$, the speed of the van is $\lambda\,\text{m s}^{-1}$ and $R = 26\lambda$ where λ is a non-zero constant.

(a) Show that $R = 260$

(4)

Later on, the van is moving **down** the same straight road. The model for the resistance to motion of the van still has magnitude 260 N.

The engine of the van is now working at a constant rate of P watts.

At the instant when the speed of the van is $12\,\text{m s}^{-1}$, the acceleration of the van is $1.8\,\text{m s}^{-2}$

(b) Find the value of P

(4)

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Question 1 continued

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Question 1 continued

(Total for Question 1 is 8 marks)

2.

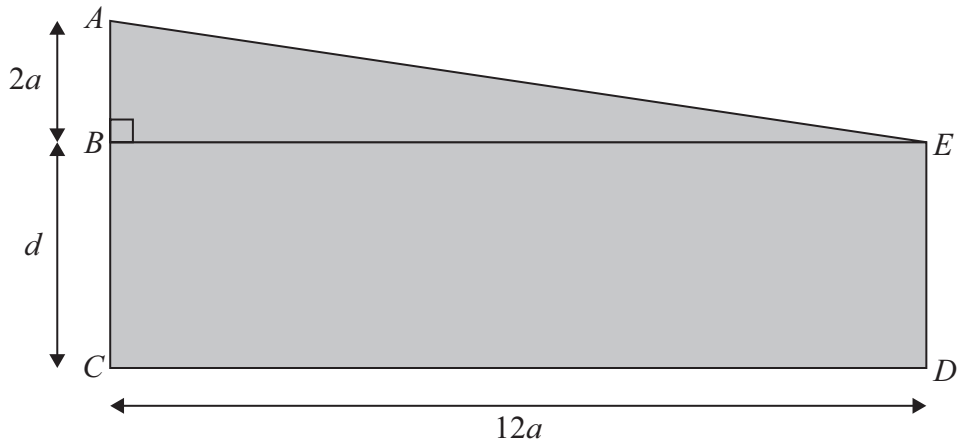


Figure 1

The uniform **lamina** *ABCDE* shown shaded in Figure 1 is formed by joining a rectangle to a right-angled triangle.

The right-angled triangle *ABE* has $AB = 2a$ and $BE = 12a$

The rectangle *BCDE* has $BE = CD = 12a$ and $BC = ED = d$

The distance of the centre of mass of the lamina from *AC* is $\bar{x}$

(a) Show that

$$\bar{x} = \frac{2a(2a + 3d)}{(a + d)}$$

(5)

The lamina has weight *W*.

A particle of weight $\frac{W}{2}$ is attached to the lamina at *D*.

The lamina is free to rotate in a vertical plane about a smooth horizontal axis through *A*. The axis is perpendicular to the plane of the lamina.

When a horizontal force of magnitude *F* is applied to the lamina at *C* towards *D*, the lamina rests in equilibrium with the line *CD* horizontal.

Given that $d = 4a$,

(b) find *F* in terms of *W*.

(4)

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Question 2 continued

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Question 2 continued

(Total for Question 2 is 9 marks)

3.

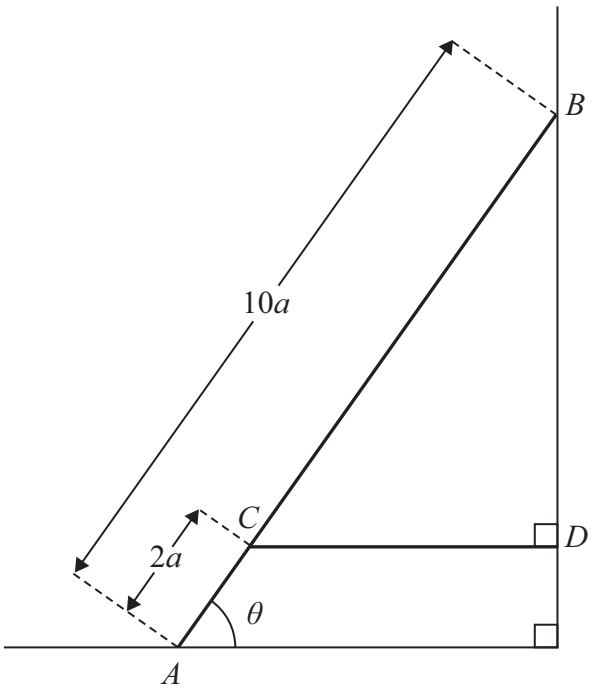


Figure 2

A uniform rod AB has mass m and length $10a$.

The end A is on smooth horizontal ground and the end B is against a smooth vertical wall.

To prevent the rod from slipping, one end of a light inextensible string is attached to the rod at the point C, where $AC = 2a$

The other end of the string is attached to the wall at the point D.

The string is parallel to the ground and in the same vertical plane as the rod.

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

The rod is inclined at an angle θ to the horizontal, as shown in Figure 2, where $0 < \theta < 90°$

The tension in the string is T.

(a) Show that

$$\tan\theta = \frac{5mg}{8T}$$

(4)

A particle of mass $3m$ is now attached to a point E on the rod and the rod remains in equilibrium.

Given that the maximum tension in the string before breaking is $2mg$ and $\tan\theta = \frac{4}{3}$

(b) find the maximum distance AE.

(5)

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Question 3 continued

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Question 3 continued

(Total for Question 3 is 9 marks)

4. [*In this question* **i** *and* **j** *are perpendicular horizontal unit vectors and position vectors are given relative to a fixed point O.*]

The velocity of a particle P at time t seconds, $t > 0$, is given by

$$\left[\left(6t - 25\sqrt{t} + 14\right)\mathbf{i} + \left(8t - 30\sqrt{t} + 7\right)\mathbf{j}\right]\text{m s}^{-1}$$

(a) Find the value of t when P is at instantaneous rest.

(3)

(b) Find the value of t when the acceleration of P is perpendicular to $(2\mathbf{i} - \mathbf{j})$

(4)

When $t = 1$, P is at the point with position vector $\left(\frac{1}{3}\mathbf{i} - 7\mathbf{j}\right)$m.

(c) Find the distance OP when $t = 4$

(6)

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Question 4 continued

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Question 4 continued

(Total for Question 4 is 13 marks)

5. At time $t = 0$, a stone S is projected from a point A on the top of a cliff.

The point A is 120 m above horizontal ground.

The stone S is projected with speed $25\,\text{m s}^{-1}$ at an angle of 60° above the horizontal.

The stone S is modelled as a particle moving freely under gravity.

For the motion of S from A until it first hits the ground

(a) find the maximum height above the ground reached by S,

(4)

(b) find the direction of motion of S when $t = 5$ seconds,

(4)

(c) find the length of time for which S is moving at a speed greater than $25\,\text{m s}^{-1}$

(3)

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Question 5 continued

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Question 5 continued

(Total for Question 5 is 11 marks)

6. Two particles, P and Q, lie at rest on a smooth horizontal surface.

The mass of P is $5m$ and the mass of Q is $3m$.

Particle P is projected towards Q with speed $3u$ and the particles collide.

The coefficient of restitution between P and Q is e, where $e > 0$

(a) Show that the speed of Q immediately after the collision is

$$\frac{15u}{8}(1 + e)$$

(5)

(b) Show that, after the collision, P and Q move in the same direction.

(3)

After the collision, Q collides with a smooth fixed vertical wall which is perpendicular to the direction of motion of Q.

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

In the collision with the wall, Q receives an impulse of magnitude $\frac{45mu}{4}$

(c) Find the value of e.

(4)

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Question 6 continued

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Question 6 continued

(Total for Question 6 is 12 marks)

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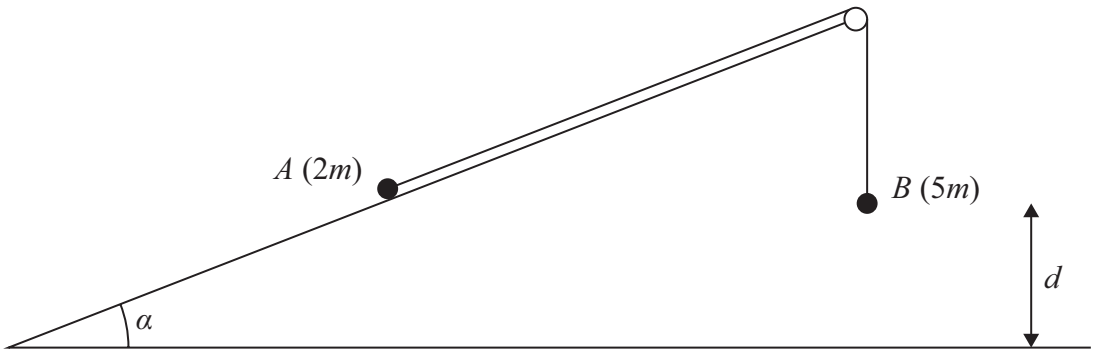


Figure 3

Figure 3 shows a rough plane inclined at an angle α to the horizontal, where $\tan\alpha = \frac{5}{12}$

The plane is fixed to horizontal ground.

A small smooth pulley is fixed at the top of the plane.

One end of a light inextensible string is attached to a particle A that is held at rest on the plane.

The string passes over the pulley and the other end of the string is attached to a particle B that hangs vertically below the pulley.

The string from A to the pulley lies along a line of greatest slope of the plane.

Particle A has mass $2m$ and particle B has mass $5m$.

The distance from B to the ground is d.

When the system is released from rest with the string taut, A begins to move up the plane and in the subsequent motion A never reaches the pulley.

The coefficient of friction between A and the plane is μ.

The work done against friction as A moves a distance d up the plane is $\frac{3mgd}{13}$

(a) Find the value of μ.

(4)

The speed of B as it hits the ground is V.

(b) **Use the work-energy principle** to find an expression for V^2 in terms of g and d.

(5)

(c) Find the speed of A when it has moved a **total** distance of $2d$ up the plane, giving your answer in terms of g and d.

(4)

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Question 7 continued

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TOTAL FOR PAPER IS 75 MARKS

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