Cambridge Assessment International Education

# Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*9016441563*

**MATHEMATICS** **9709/41**

Paper 4 Mechanics **October/November 2025**

**1 hour 15 minutes**

You must answer on the question paper.

You will need: List of formulae (MF19)

**INSTRUCTIONS**

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- If additional space is needed, you should use the lined page at the end of this booklet; the question number or numbers must be clearly shown.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- Where a numerical value for the acceleration due to gravity ($g$) is needed, use $10\,\text{m}\,\text{s}^{-2}$.

**INFORMATION**

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages.


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**[Turn over**

**1** A car of mass 900 kg is moving along a straight horizontal road against a constant resistance to motion of 350 N. At an instant when the car is moving at $15\,m\,s^{-1}$ its acceleration is $0.25\,m\,s^{-2}$.

**(a)** Find the driving force of the car's engine at this instant. [2]

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**(b)** Find the power of the car's engine at this instant. [2]

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**2** Two particles, $P$ and $Q$, of masses 3 kg and 5 kg respectively, are at rest on a smooth horizontal plane. $P$ is projected at a speed of $4\,\text{m s}^{-1}$ directly towards $Q$. After $P$ and $Q$ collide, $P$ has speed $1\,\text{m s}^{-1}$.

**(a)** Find the two possible speeds of $Q$ after the collision. [3]

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It is given that $\lambda$ J of kinetic energy, where $\lambda > 0$, is lost during the collision.

**(b)** Find the value of $\lambda$. [2]

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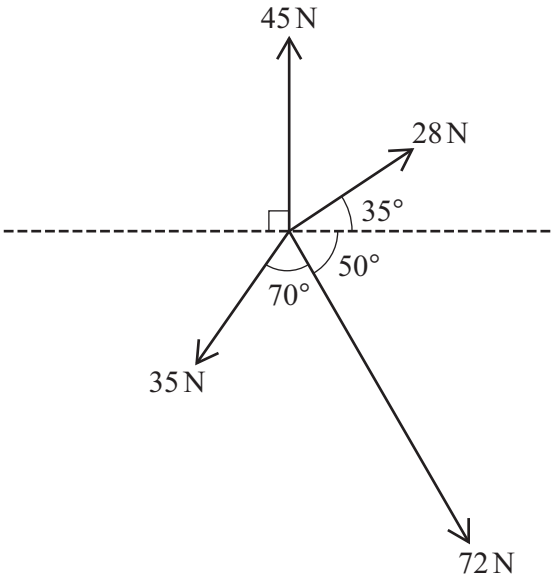
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Coplanar forces of magnitudes 45 N, 28 N, 72 N and 35 N act at a point in the directions shown in the diagram.

Find, in either order, the magnitude and direction of the resultant force. [6]

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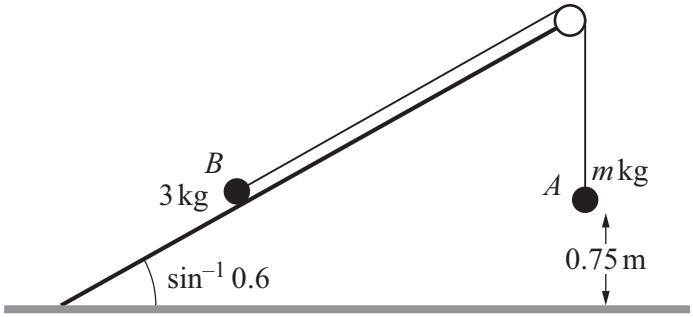
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Two particles, $A$ and $B$, of masses $m$ kg and 3 kg respectively, are connected by a light inextensible string. Particle $B$ is on a fixed plane which is at an angle of $\sin^{-1} 0.6$ to the horizontal ground. The string passes over a fixed smooth pulley at the top of the plane. Particle $A$ hangs vertically below the pulley and is 0.75 m above the ground (see diagram).

The system is released from rest. In the subsequent motion $B$ moves up a line of greatest slope of the plane and does not reach the pulley. As $B$ moves up the plane there is a constant resistance to its motion of magnitude $\frac{10}{3}$ N. The speed of $A$ immediately before it hits the ground is $2\,\text{m}\,\text{s}^{-1}$.

Use an energy method to find the value of $m$. [6]

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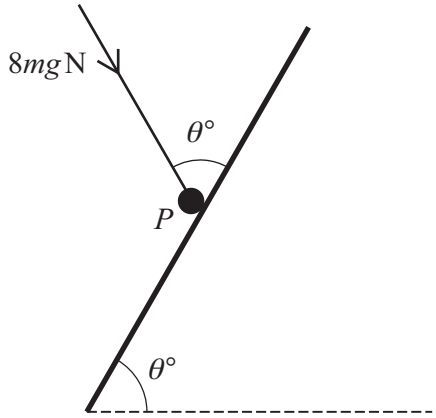
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A particle $P$ of mass $m$ kg is in equilibrium on a rough plane inclined at an angle $\theta°$ to the horizontal. The equilibrium of $P$ is maintained by a force of magnitude $8mg$ N making an angle $\theta°$ with a line of greatest slope (see diagram). The coefficient of friction between $P$ and the plane is 0.5 and $P$ is on the point of slipping down the plane.

Find the value of $\theta$. [6]

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**6** A particle $A$ of mass 2.5 kg is released from rest from the top of a smooth plane, which makes an angle of $\sin^{-1} 0.2$ with the horizontal. The particle $A$ collides 2 seconds later with a particle $B$, of mass 3 kg, which is moving up a line of greatest slope of the plane. The speed of $B$ immediately before the collision is $3.5\,\text{m}\,\text{s}^{-1}$. Immediately after the collision, $B$ has a velocity of $0.5\,\text{m}\,\text{s}^{-1}$ down the plane.

Find the distance $A$ moves up the plane after the collision. [6]

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**7** A particle $P$ starts from a point $O$ and moves in a straight line. The velocity $v\,\text{m}\,\text{s}^{-1}$ of $P$, at time $t$ s after leaving $O$, is given by $v = \frac{1}{3}(2t-3)(t-4)$.

**(a)** Find the acceleration of $P$ when $t = 2$. [2]

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**(b)** Find the total distance travelled by $P$ in the first 3 seconds of its motion. [5]

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**(c)** Determine whether $P$ returns to $O$. [2]

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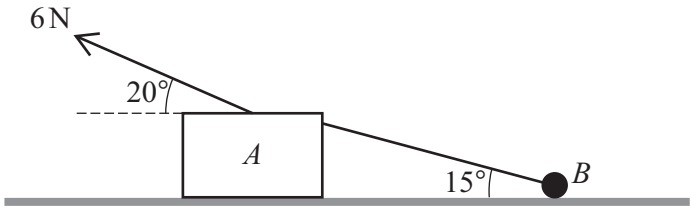
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**8**




A block $A$ of mass 2 kg and a particle $B$ of mass 0.5 kg are connected by a light inextensible string inclined at 15° to the horizontal. They are pulled across a horizontal surface with acceleration $1.2\,\text{m}\,\text{s}^{-2}$ by a force of magnitude 6 N, applied to $A$, acting at 20° above the horizontal as shown in the diagram. The string and the force applied to $A$ are in the same vertical plane.

The contact between $B$ and the surface is smooth and the contact between $A$ and the surface is rough.

**(a)** Find the tension in the string. [2]

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**(b)** Find the coefficient of friction between $A$ and the surface. [6]

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## Additional page

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