



Cambridge International AS & A Level

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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 m 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.

- 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 m s^{-1} directly towards Q . After P and Q collide, P has speed 1 m s^{-1} .

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

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

(b) Find the value of λ . [2]

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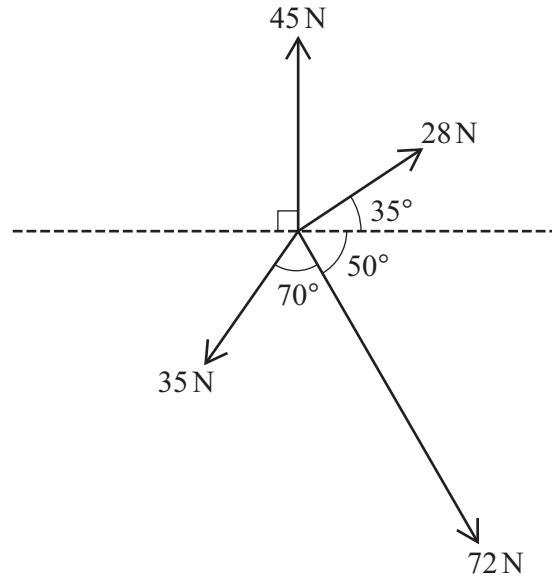
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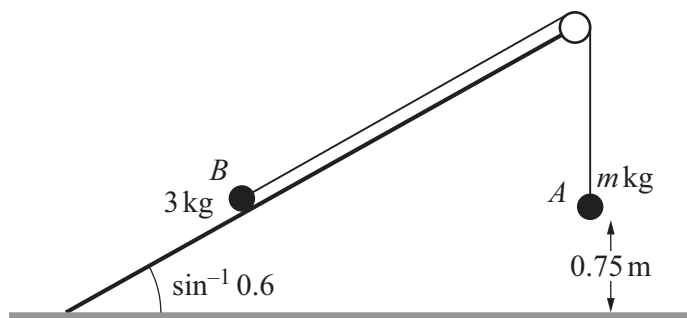


Coplanar forces of magnitudes 45 N, 28 N, 72 N and 35 N act at a point in the directions shown in the diagram.

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

[6]

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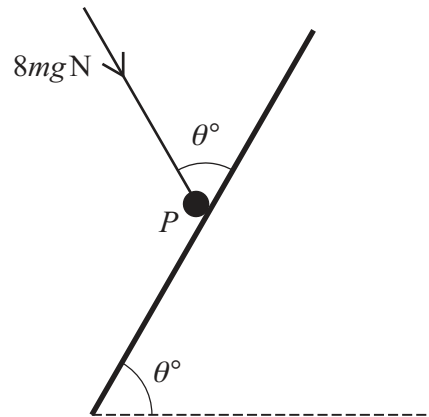
Two particles, A and B , of masses m kg and 3 kg respectively, are connected by a light inextensible string. Particle B is on a fixed plane which is at an angle of $\sin^{-1} 0.6$ to the horizontal ground. The string passes over a fixed smooth pulley at the top of the plane. Particle A hangs vertically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

Use an energy method to find the value of m .

[6]

This image shows a full page of a handwriting practice worksheet. It consists of multiple sets of three horizontal dashed lines spaced evenly down the page, providing a guide for letter height and placement. The background is plain white, and there are no other markings or text present.



A particle P of mass m kg is in equilibrium on a rough plane inclined at an angle θ° to the horizontal. The equilibrium of P is maintained by a force of magnitude $8mg$ N making an angle θ° 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 θ .

[6]

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



- 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 m s^{-1} . Immediately after the collision, B has a velocity of 0.5 m 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 $v \text{ m s}^{-1}$ of P , at time $t \text{ s}$ after leaving O , is given by $v = \frac{1}{3}(2t-3)(t-4)$.

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

[2]

[illegible]

(b) Find the total distance travelled by P in the first 3 seconds of its motion.

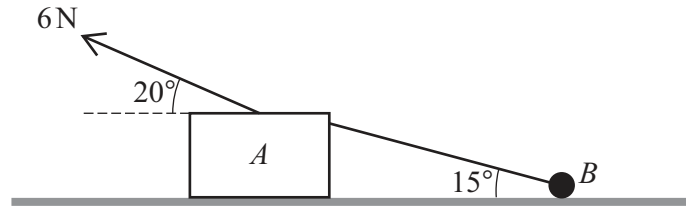
[5]

[illegible]



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





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 m 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]

[illegible]



(b) Find the coefficient of friction between A and the surface.

[6]

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Additional page

If you use the following page to complete the answer to any question, the question number must be clearly shown.

[illegible]

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