



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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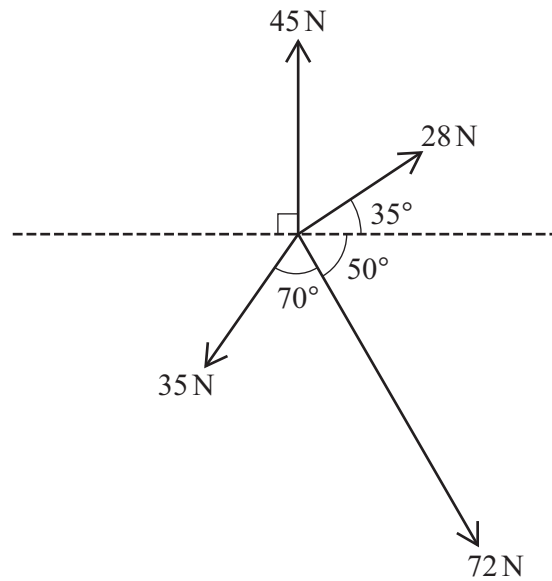
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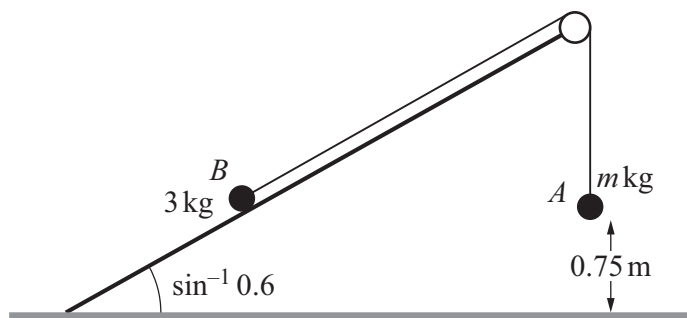


Coplanar forces of magnitudes 45 N, 28 N, 72 N and 35 N act at a point in the directions shown in the diagram.

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} .

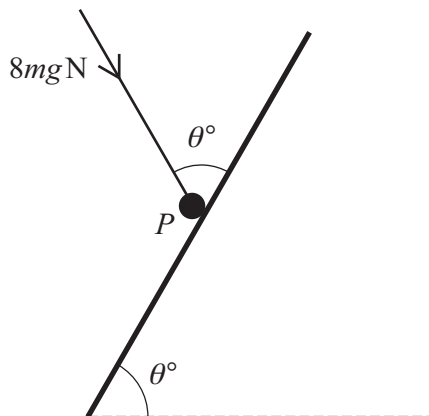
Use an energy method to find the value of m .

[6]

[illegible]



5



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]

[illegible]



- 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]

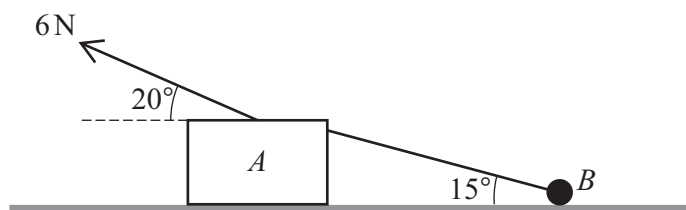
[illegible]



(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]

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

[6]

[illegible]



Additional page

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