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CAMBRIDGE
International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 3 3 9 1 5 1 5 3 0 4 *

MATHEMATICS **9709/45**

Paper 4 Mechanics **May/June 2026**

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. Do **not** use correction fluid or tape.
- 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

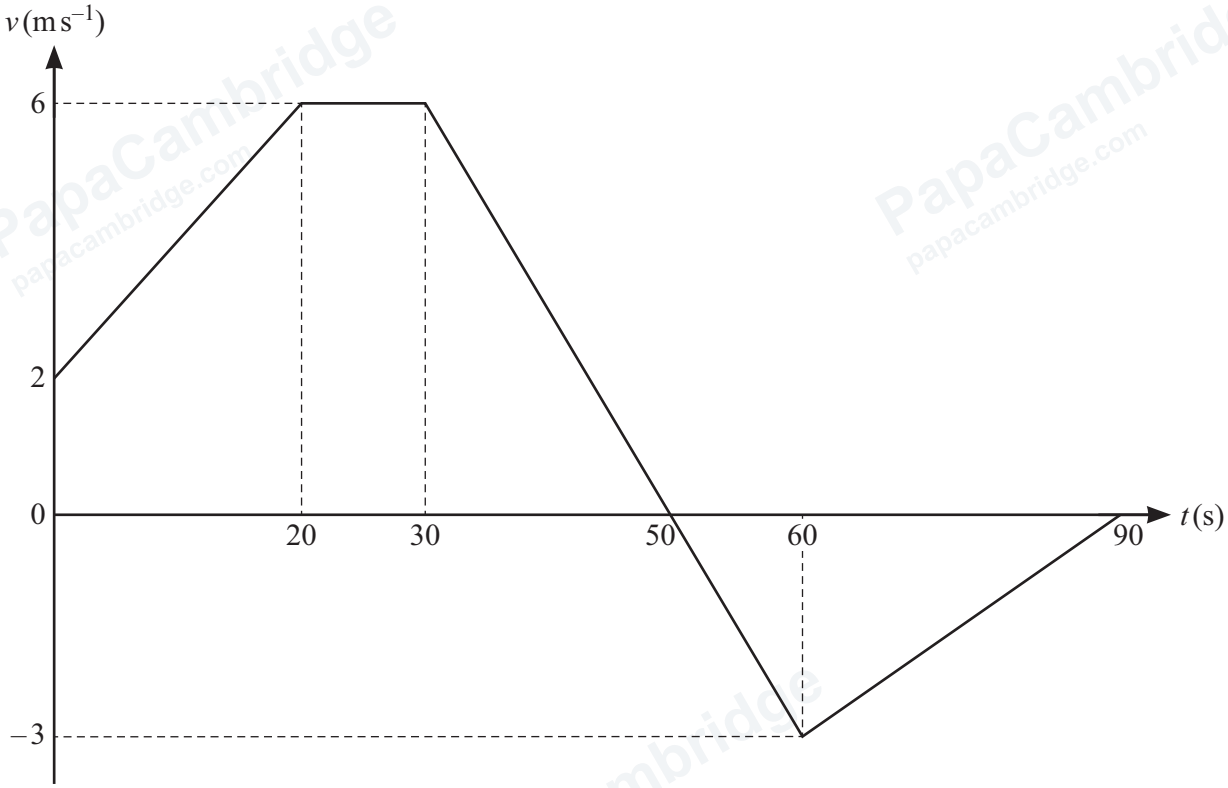
- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages.

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[Turn over

1



The diagram shows the velocity-time graph of the motion of an athlete who is running in a straight line. The athlete's velocity t seconds after passing a fixed point O is $v\,\text{m s}^{-1}$. The graph consists of 4 straight line segments. The athlete is at point P at time $t = 90$.

(a) Find the distance OP. [2]

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(b) Find the total distance which the athlete runs in the 90s after passing O. [1]

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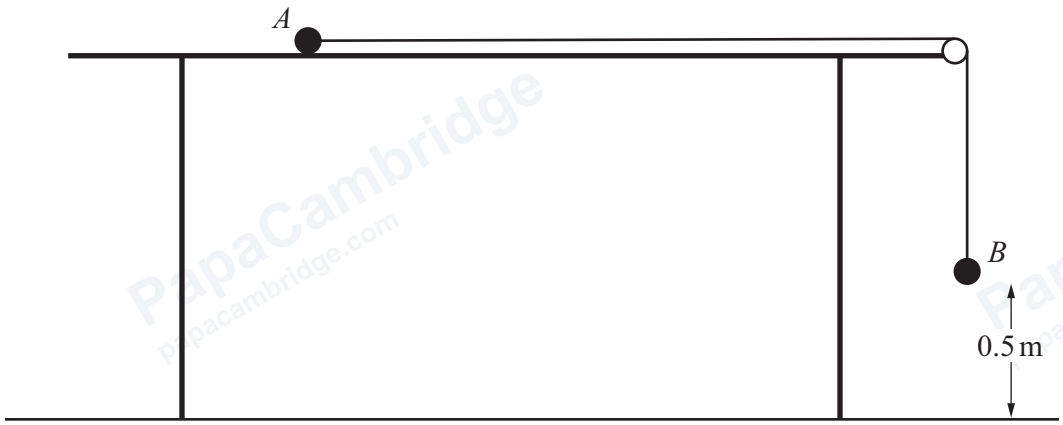
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2



A particle A of mass 0.6 kg rests on a smooth horizontal table and is attached to one end of a light inextensible string. The string passes over a small smooth pulley fixed at the edge of the table. The other end of the string is attached to a particle B of mass 0.4 kg which hangs freely below the pulley. The system is released from rest with the string taut and with B at a height of 0.5 m above horizontal ground (see diagram).

(a) Find the tension in the string and the magnitude of the acceleration of B. [4]

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(b) Find the time that it takes for B to reach the ground after the system is released. You should assume that A does not reach the pulley before B reaches the ground. [2]

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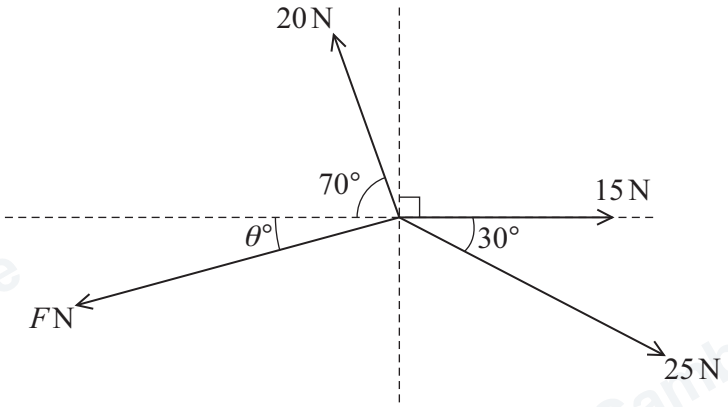
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Four coplanar forces of magnitudes 20 N, 15 N, 25 N and F N act at a point in the directions shown in the diagram.

Given that the four forces are in equilibrium, find the value of F and the value of θ. [6]

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4 A car of mass 1200 kg is travelling along a straight horizontal road. There is a constant resistance force of magnitude R N acting on the car. Points A, B and C are on the road in that order.

(a) The car takes 70 s to travel from A to B at constant speed. The distance AB is 1400 m. The power produced by the car's engine is 15 kW.

Find the value of R. [3]

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(b) At B, the power produced by the car's engine is increased to 25 kW. The car travels a distance of 500 m from B to C. The speed of the car at C is 40 ms^{-1} and the value of R is unchanged.

Find the time that the car takes to travel from B to C. [4]

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5 A particle moves in a straight line through two points O and A. The particle starts from A and initially moves away from O. The velocity of the particle t seconds after leaving A is $v\,\text{m s}^{-1}$, where $v = 6t - t^{\frac{3}{2}}$.

(a) Given that the particle is 700 m from O when $t = 25$, find the distance OA. [4]

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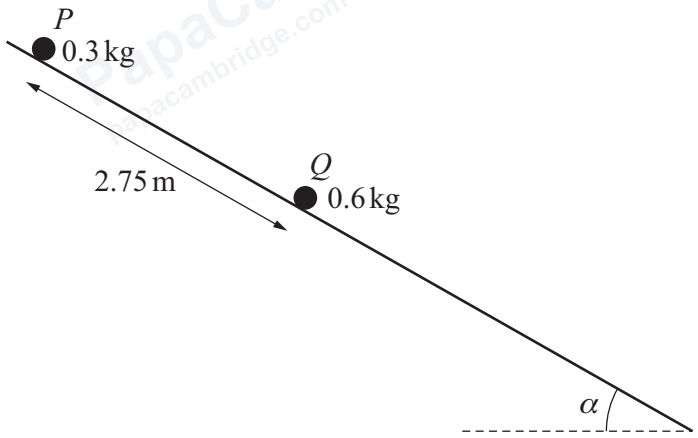
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(b) Given that $t > 0$, find the distance travelled by the particle between the time at which its acceleration is zero and the time at which its velocity is zero. [6]

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6



Particles P and Q have masses 0.3 kg and 0.6 kg respectively. The particles are held at rest at a distance of 2.75 m apart on a line of greatest slope of a rough plane inclined at angle α to the horizontal, where $\sin\alpha = 0.28$ (see diagram). The coefficient of friction between each particle and the plane is 0.5.

Particles P and Q are then released.

(a) Show that neither particle moves. [3]

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Particle P is now projected directly towards Q with speed $6\,\text{m}\,\text{s}^{-1}$.

(b) Find the speed of P immediately before it collides with Q. [4]

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(c) Immediately after the collision, P begins to move with speed $1\,\text{m}\,\text{s}^{-1}$ up the plane.

Find the distance between the two particles when they both come to rest after the collision. [5]

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7 A cyclist travels along a straight horizontal road with constant acceleration a ms^{-2}. She passes through points A, B, C and D. The distances AB and CD are 50 m and 100 m respectively. The times that she takes to travel from A to B, from B to C and from C to D are all 10 s.

Find, in either order, the value of a and the increase in the speed of the cyclist between A and D. [6]

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Additional page

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