



# Cambridge International AS & A Level

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## MATHEMATICS

**9709/42**

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  $10 \text{ m s}^{-2}$ .

## 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 **16** pages. Any blank pages are indicated.



- 1 A car of mass 960 kg is moving on a straight horizontal road. There is a constant force of magnitude 620 N resisting the motion of the car.

- (a) Calculate the power developed by the engine of the car when it is moving at a constant speed of  $25 \text{ m s}^{-1}$ . [2]

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- (b) Given that the power is suddenly increased by 12 kW, find the instantaneous acceleration of the car. [2]

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- 2 Two particles,  $A$  and  $B$ , of masses  $2.5 \text{ kg}$  and  $3.5 \text{ kg}$  respectively are at rest on a straight smooth horizontal track. Particle  $B$  is situated  $9 \text{ m}$  from a vertical wall which is fixed at right angles to the track.

Particle  $A$  is projected directly towards  $B$  with a speed of  $3 \text{ m s}^{-1}$ . In the subsequent motion,  $A$  collides and coalesces with  $B$  to form particle  $C$ . Particle  $C$  then collides directly with the wall and rebounds. The collision of  $C$  with the wall reduces the speed of  $C$  by  $25\%$ .

- (a) Find the speed of  $C$  after it rebounds from the wall. [2]

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- (b) Hence find the time from the instant at which  $A$  and  $B$  collide until  $C$  is once again a distance of  $9 \text{ m}$  from the wall. [2]

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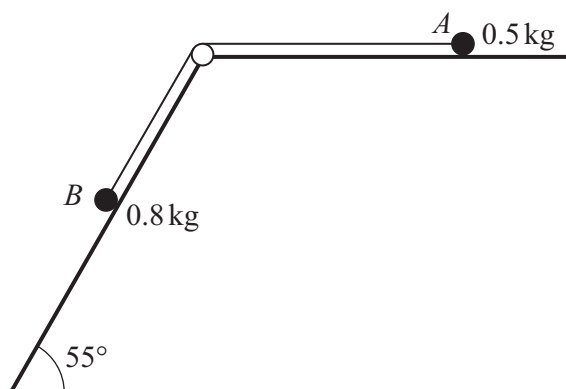
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3



Two particles,  $A$  and  $B$ , of masses  $0.5\text{ kg}$  and  $0.8\text{ kg}$  respectively are attached to the ends of a light inextensible string. The string passes over a small smooth pulley fixed at the end of a rough horizontal plane and to the top of a smooth inclined plane. Particle  $A$  is held on the horizontal plane, while  $B$  lies on the inclined plane, which makes an angle of  $55^\circ$  with the horizontal. The string is in the same vertical plane as a line of greatest slope of the inclined plane (see diagram).

Particle  $A$  is released from rest with the string taut. Particle  $B$  moves 0.3 m down the inclined plane in 0.4 s.

- (a)** Find the tension in the string.

[4]

[illegible]

(b) Find the coefficient of friction between  $A$  and the horizontal plane.

[3]

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(c) After  $B$  has been moving for  $0.4\text{ s}$ , the string suddenly breaks. Given that  $A$  subsequently comes to rest on the horizontal plane, find the work done by the frictional force in bringing  $A$  to rest. You may assume that  $A$  does not reach the pulley.

[3]

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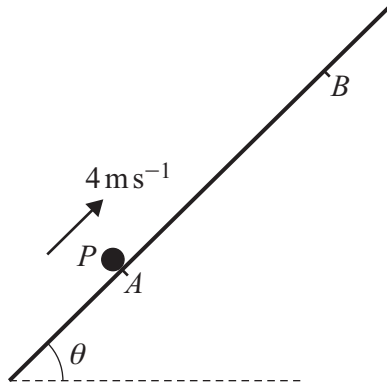
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A particle  $P$  is projected from a point  $A$  with speed  $4 \text{ m s}^{-1}$  up a line of greatest slope of a rough plane inclined at an angle  $\theta$  to the horizontal, where  $\tan \theta = \frac{4}{3}$ .

$P$  comes to instantaneous rest at a point  $B$  on the plane (see diagram).

The coefficient of friction between  $P$  and the plane is  $\frac{1}{3}$ .

- (a)** Using an energy method, show that the distance  $AB$  is 0.8 m.

[4]

[illegible]



**(b)** After coming to instantaneous rest at  $B$ , the particle slides down the plane.

Find the total time from the instant at which  $P$  is projected from  $A$  until it returns to  $A$ . [5]

This image shows a full page of white paper with horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

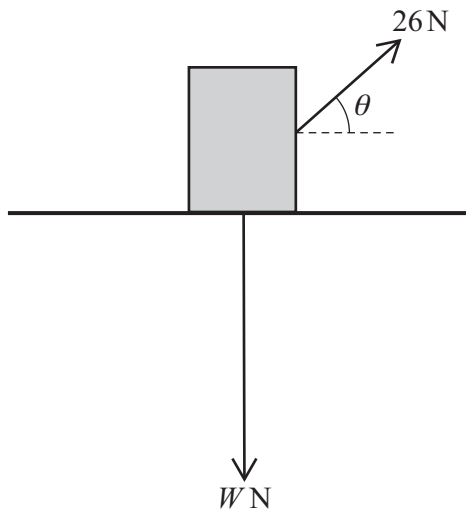


- 5** The points  $A$  and  $B$  are at the same vertical height  $h$  m above horizontal ground. A particle  $P$  is released from rest from  $A$ . One second later, a particle  $Q$  is projected vertically downwards from  $B$  with speed  $18 \text{ m s}^{-1}$ .

Given that  $P$  and  $Q$  reach the ground at the same time, find the value of  $h$ . [6]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

[illegible]



A crate of weight  $W$  N is at rest on rough horizontal ground. The crate is pulled at a constant acceleration of  $1.5 \text{ m s}^{-2}$  along the ground in a straight line by a light rope. The rope is inclined at an angle of  $\theta$  to the horizontal, where  $\theta = \sin^{-1} \frac{5}{13}$ . The tension in the rope is 26 N (see diagram). The coefficient of friction between the crate and the ground is 0.25.

- (a)** Find the value of  $W$ .

[5]

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.



- (b) When the crate reaches a point  $A$ , the rope is removed. The speed of the crate at  $A$  is  $8 \text{ m s}^{-1}$ .

The crate comes to rest at a point  $B$ .

Find the distance  $AB$ .

[3]





7 A particle  $P$  moves in a straight line. The velocity  $v \text{ m s}^{-1}$  of  $P$  at time  $t \text{ s}$ , where  $t \geq 0$ , is given by

$$v = k_1(4t+11)^{\frac{1}{2}} - \frac{1}{4}(2t+1)^2 + k_2,$$

where  $k_1$  and  $k_2$  are constants. When  $t = 1.25$  the deceleration of  $P$  is  $0.5 \text{ m s}^{-2}$ .

**(a)** Find the value of  $k_1$ .

[4]

This image shows a full page of white paper designed for handwriting practice. It features approximately 20 evenly spaced horizontal dotted lines running from left to right across the entire width of the page. There are no margins, text, or other markings present.



[5]

This image shows a full page of white paper with horizontal dashed lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

[illegible]





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