



# Cambridge International AS & A Level

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## MATHEMATICS

9709/43

Paper 4 Mechanics

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

### 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 Two particles  $P$  and  $Q$ , of masses  $0.1 \text{ kg}$  and  $0.3 \text{ kg}$  respectively, are at rest on a smooth horizontal plane.  $P$  is projected directly towards  $Q$  with speed  $4u \text{ ms}^{-1}$ . At the same instant,  $Q$  is projected directly towards  $P$  with speed  $u \text{ ms}^{-1}$ . After  $P$  and  $Q$  collide,  $P$  moves with speed  $2 \text{ ms}^{-1}$  and  $Q$  moves with speed  $4 \text{ ms}^{-1}$ .

(a) Find the two possible values of  $u$ .

[3]

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(b) Find the largest possible loss of kinetic energy in the collision.

[2]

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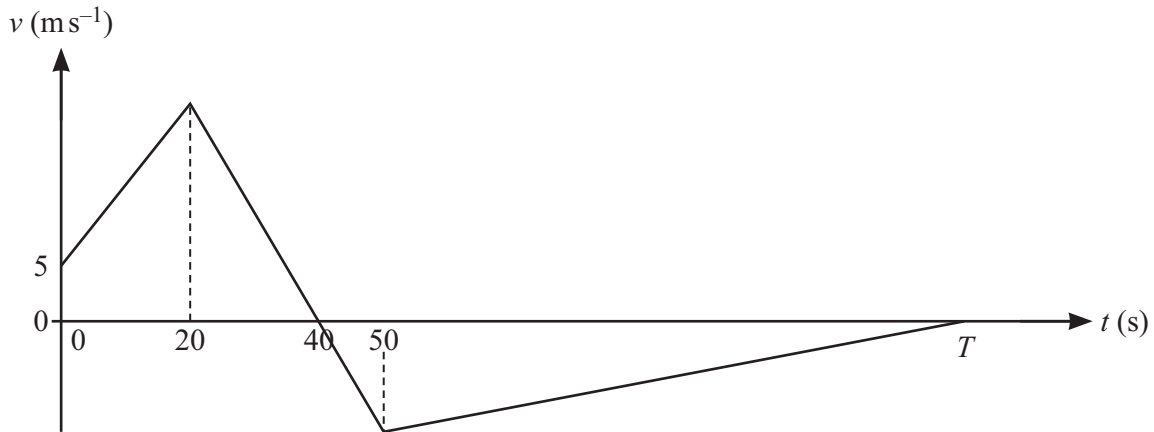


- Find the value of  $X$  and the value of  $T$ .

[4]

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.

3



The diagram shows a velocity-time graph which models the motion of a particle. The graph consists of 3 straight line segments. The velocity of the particle at time  $t$  s after passing a fixed point  $O$  is  $v$   $\text{ms}^{-1}$ . The particle leaves  $O$  with a velocity of  $5 \text{ ms}^{-1}$  and accelerates at  $0.75 \text{ ms}^{-2}$  for 20 s. The particle then decelerates for the next 30 s. At  $t = 40$ , the velocity of the particle is zero. After  $t = 40$ , the particle starts to travel back to  $O$ , coming to rest at  $O$  at time  $T$  s.

(a) Find the value of  $T$ .

[5]

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(b) Find the acceleration of the particle from  $t = 50$  to  $t = T$ .

[2]

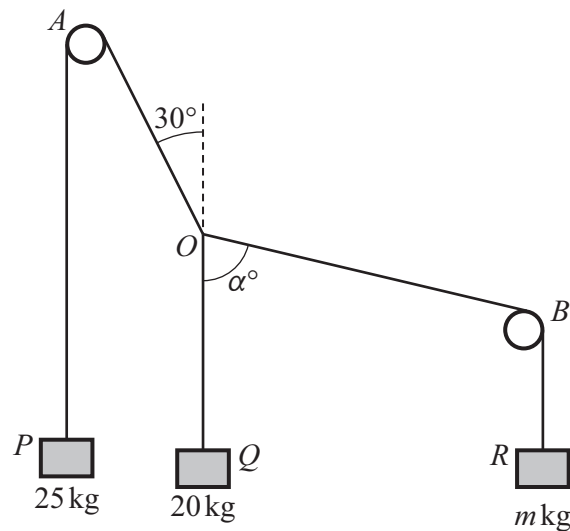
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Three blocks  $P$ ,  $Q$  and  $R$ , of masses 25 kg, 20 kg and  $m$  kg respectively, are held in equilibrium by three light inextensible strings  $OP$ ,  $OQ$  and  $OR$ . The strings  $OP$  and  $OR$  both pass over small fixed smooth pulleys  $A$  and  $B$  respectively, with  $P$  and  $R$  hanging vertically below the pulleys. The block  $Q$  hangs vertically below the point  $O$ . The angle between  $OA$  and the vertical is  $30^\circ$  and the angle  $BOQ = \alpha^\circ$  (see diagram).

Find the value of  $m$  and the value of  $\alpha$ .

[6]

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

- Show that  $k = 0.5$ , and find the acceleration of the van when its speed is  $25 \text{ ms}^{-1}$  on this straight horizontal road. [4]

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



(b) Find the value of  $a$  and the value of  $\theta$ . [5]

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 or typing. There are no margins, text, or other markings on the page.







**(b)** Find the work done against the resistance force as the man moves from  $B$  to  $C$ . [4]

[illegible]

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This image shows a full page of primary-ruled paper. It features multiple horizontal rows, each defined by two parallel dashed lines. The rows are evenly spaced and extend across the entire width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the paper.



[4]

This image shows a full page of a handwriting practice worksheet. It consists of approximately 20 horizontal rows. Each row is defined by two parallel dashed lines, creating a series of uniform gaps for writing. The lines are evenly spaced across the entire page, providing a guide for letter height and placement. There is no text or other markings on the page.

This image shows a full page of a handwriting practice worksheet. It consists of multiple sets of three horizontal dashed lines, providing a guide for letter height and placement. The lines are evenly spaced across the entire page, which is otherwise blank.

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