



Cambridge International AS & A Level

CANDIDATE
NAME
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MATHEMATICS**9709/41**

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 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.

- Find the tension in the rope.

[4]

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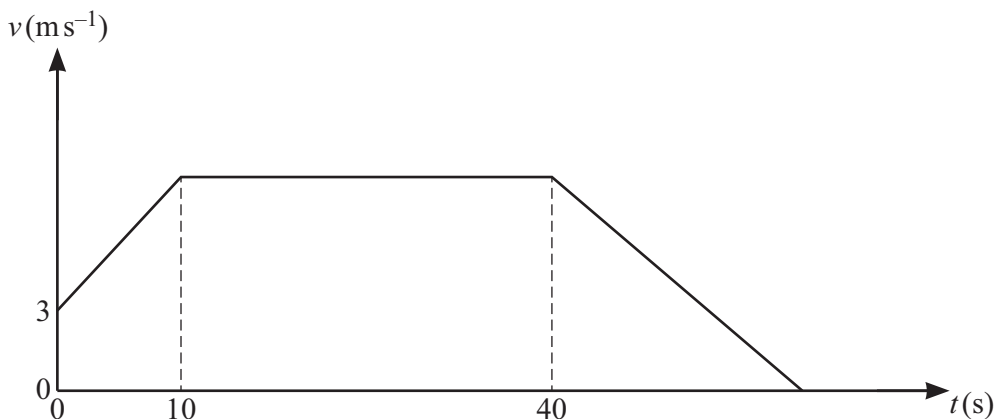
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Three coplanar forces of magnitudes P N, 5 N and 10 N act at a point O , as shown in the diagram. The resultant of the three forces has magnitude Q N and acts in a direction perpendicular to the force of magnitude P N.

Find the value of P and the value of Q . [4]

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The diagram shows the velocity-time graph of the motion of a cyclist. The graph consists of three straight line segments. The cyclist passes a point O with speed 3 m s^{-1} and then accelerates for 10 s with constant acceleration 0.5 m s^{-2} . He then travels at constant speed for 30 s before decelerating, coming to rest at point P , covering a distance of 80 m whilst decelerating.

- (a) Find the total time taken for the journey from O to P . [3]

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- (b) On the given axes, sketch a displacement-time graph for the cyclist's journey from O to P , showing on your graph the distances travelled after 10 s and 40 s. [4]



Handwriting practice lines consisting of 12 horizontal dotted lines.





4 A lorry of mass 18 000 kg is travelling along a straight road.

(a) On a horizontal section of the road, the power of the lorry's engine is constant. There is a constant resistance to motion of 1600 N.

(i) The steady speed which the lorry can maintain with the engine working at power P is 30 ms^{-1} .

Find the value of P .

[1]

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(ii) At an instant when the speed of the lorry is 16 ms^{-1} , its engine is working at a power of 40 kW.

Find the acceleration of the lorry at this instant.

[2]

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(b) When the lorry has reached a speed of 20 ms^{-1} , it begins to ascend a section of road inclined at an angle α° to the horizontal. The engine now works at a power of 120 kW. There is no change in the lorry's speed as it ascends the hill. The constant resistance to motion remains 1600 N.

Find the value of α .

[3]

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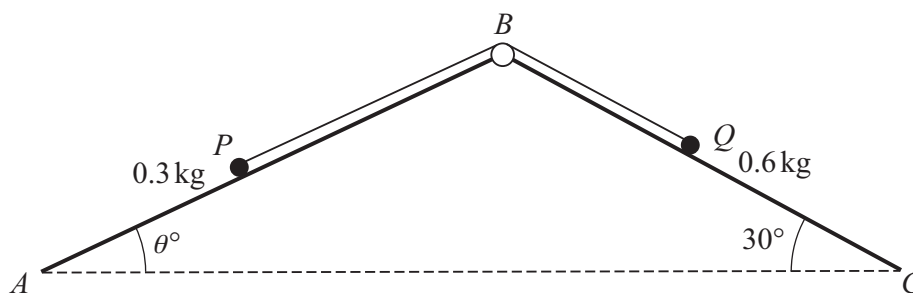


- (a) Find the value of m and the value of u . [3]

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(b) Find the value of v and the value of w . [4]

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(a) It is given that the plane BC is smooth.

Find the tension in the string and the acceleration of Q .

[5]

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- Use an energy method to find the speed of Q when it has moved 2 m down the plane. [4]

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A second particle Y moves along another straight track, starting from a point P at time $t = 0$. The acceleration of Y at time ts is $a \text{ ms}^{-2}$, where $a = 0.8 - 0.6t$. The velocity of Y when it leaves P is 7.5 ms^{-1} .

- (b)** When the velocity of Y is -9.6 ms^{-1} , show that the displacement of X from O is equal to the displacement of Y from P . [7]

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