



Cambridge International AS & A Level

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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 [].

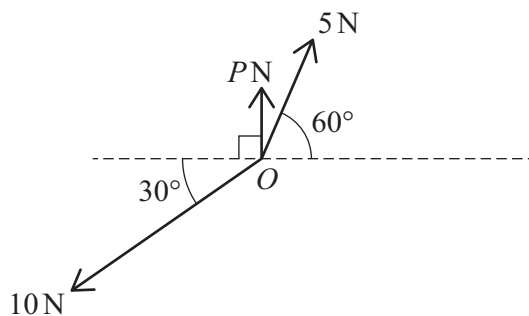
This document has **12** pages.

- Find the tension in the rope.

This image shows a full page of primary-ruled paper. It features multiple sets of horizontal dashed lines spaced evenly down the page, providing a guide for handwriting practice. The background is white, and there are no margins or other markings present.



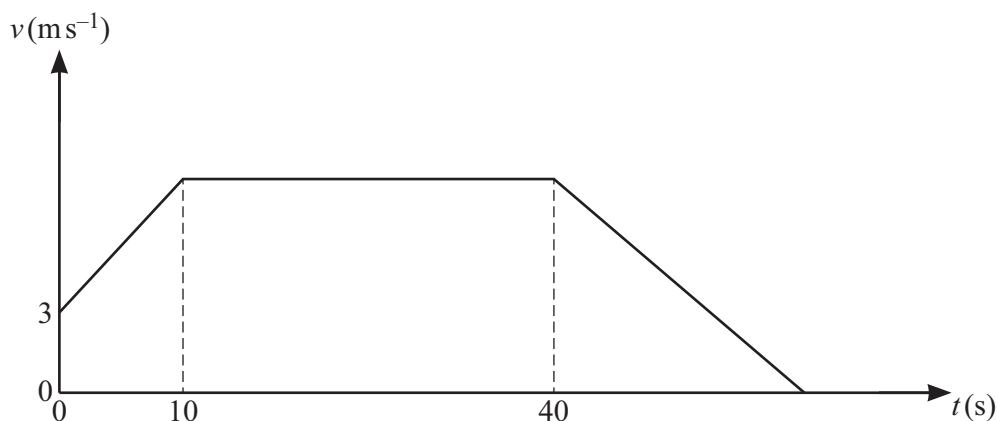
2



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]

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.



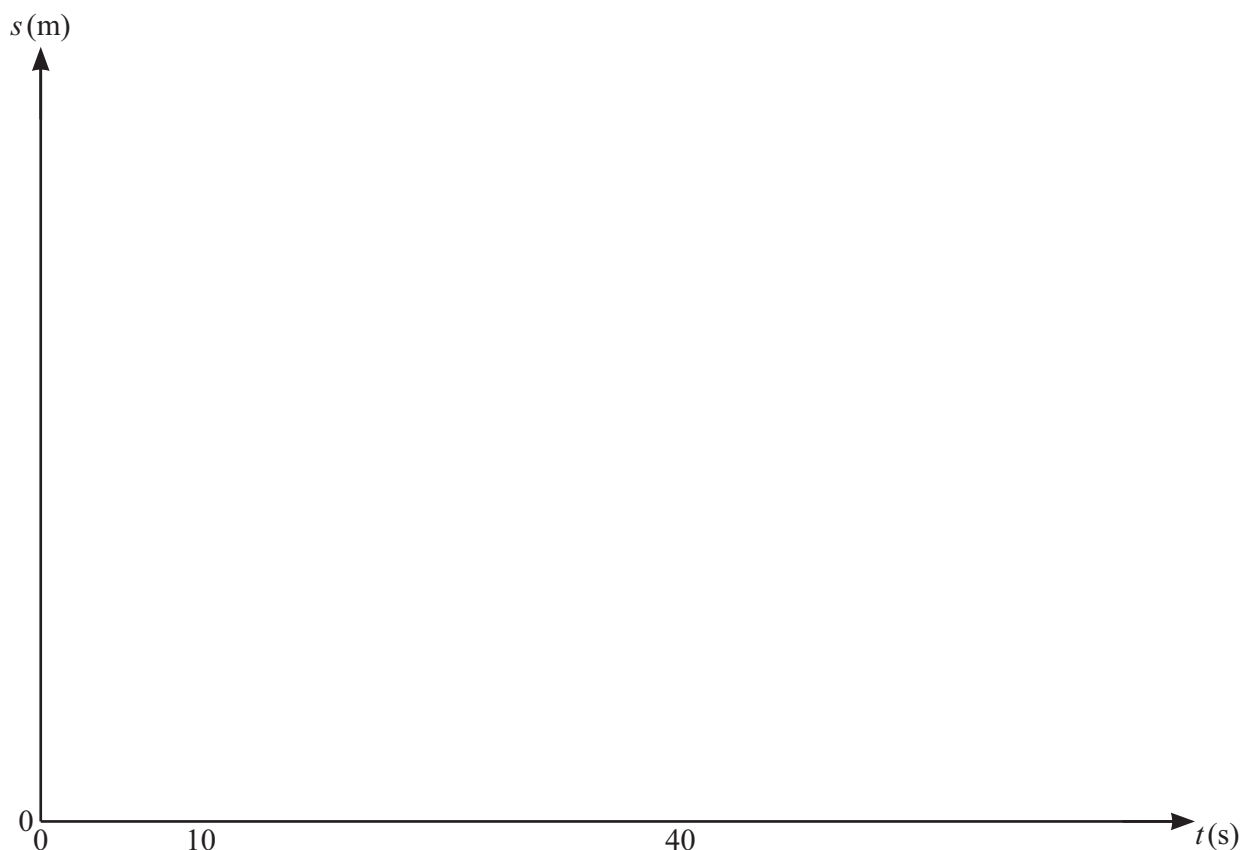
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- (b) On the given axes, sketch a displacement-time graph for the cyclist's journey from O to P , showing on your graph the distances travelled after 10 s and 40 s. [4]



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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 PW is 30 m s^{-1} .

Find the value of P . [1]

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(ii) At an instant when the speed of the lorry is 16 m s^{-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 m s^{-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]

[illegible]

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

[illegible]



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

[illegible]

- [illegible]



(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]

[illegible]

[illegible]

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