



Cambridge International AS & A Level

CANDIDATE
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MATHEMATICS**9709/41**

Paper 4 Mechanics

October/November 2024**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 **16** pages. Any blank pages are indicated.

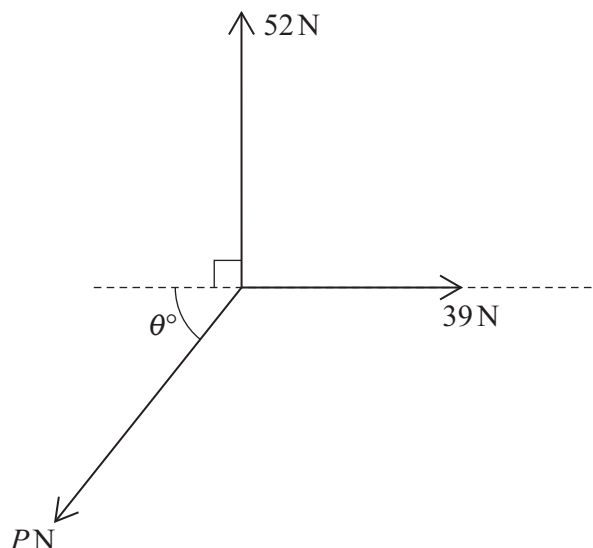


(a) Given that the plane is smooth, use an energy method to find the speed of the particle at B . [2]

[illegible]

- Find the value of F . [3]

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.



Coplanar forces of magnitudes 52 N, 39 N and P N act at a point in the directions shown in the diagram. The system is in equilibrium.

Find the values of P and θ .

[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.

- 4 A bus travels between two stops, A and B . The bus starts from rest at A and accelerates at a constant rate of $a \text{ m s}^{-2}$ until it reaches a speed of 16 m s^{-1} . It then travels at this constant speed before decelerating at a constant rate of $0.75a \text{ m s}^{-2}$, coming to rest at B . The total time for the journey is 240 s.

(a) Sketch the velocity-time graph for the bus's journey from A to B .

[1]



- (b) Find an expression, in terms of a , for the length of time that the bus is travelling with constant speed. [2]

- (c) Given that the distance from A to B is 3000 m, find the value of a .

[3]

This image shows a single sheet of white paper with ten horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and extend across the width of the page. There is no handwriting or other markings on the paper.

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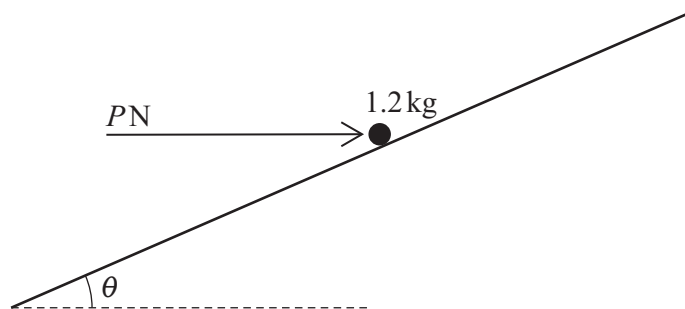




(c) Find the time from A being projected until C returns to O .

[5]

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 dotted lines, creating a series of uniform gaps for letter height. The entire page is otherwise blank, with no margins, text, or other markings.



A particle of mass 1.2 kg is placed on a rough plane which is inclined at an angle θ to the horizontal, where $\sin \theta = \frac{7}{25}$. The particle is kept in equilibrium by a horizontal force of magnitude $P \text{ N}$ acting in a vertical plane containing a line of greatest slope (see diagram). The coefficient of friction between the particle and the plane is 0.15 .

Find the least possible value of P .

[6]

[illegible]

[illegible]



- 7 A car has mass 1200 kg. When the car is travelling at a speed of $v \text{ m s}^{-1}$, there is a resistive force of magnitude $k v \text{ N}$. The maximum power of the car's engine is 92.16 kW.

(a) The car travels along a straight level road.

- (i) The car has a greatest possible constant speed of 48 m s^{-1} .

Show that $k = 40$.

[1]

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- (ii) At an instant when its speed is 45 m s^{-1} , find the greatest possible acceleration of the car. [3]

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Find the greatest possible speed of the car going up the hill. [4]

[illegible]

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[illegible]

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