



Cambridge International AS & A Level

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MATHEMATICS**9709/42**

Paper 4 Mechanics

February/March 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 **16** pages. Any blank pages are indicated.

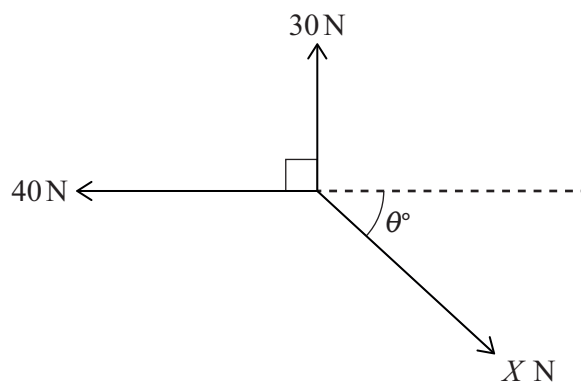


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3



Three coplanar forces of magnitudes 40 N, 30 N and X N act at a point in the directions shown in the diagram.

Given that the forces are in equilibrium, find the values of θ and X . [4]

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- 2 A cyclist is travelling along a straight horizontal road at a speed of 4 m s^{-1} when she passes a point O . She accelerates at a constant rate for a distance of 42 m, reaching a speed of $V \text{ m s}^{-1}$. She maintains the speed of $V \text{ m s}^{-1}$ for 50 m and then decelerates at 2 m s^{-2} before coming to rest. The distance travelled while decelerating is 16 m.

(a) Find the value of V . [2]

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(b) Find the total time for which she is in motion from the instant that she passes O . [3]

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3 An aeroplane is flying at a constant speed.

- (a) The aeroplane is flying horizontally. The aeroplane's engines are producing a constant power of 5500 kW, and the aeroplane experiences a constant horizontal resistance force of 25 kN.

Find the speed of the aeroplane.

[2]

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- (b) The aeroplane then ascends 300 m in 50 s, while maintaining the same speed. The resistance force is no longer constant, and the work done against the resistance force in ascending the 300 m is 270 000 kJ. The mass of the aeroplane is 60 000 kg.

Find the average power of the aeroplane's engines.

[4]

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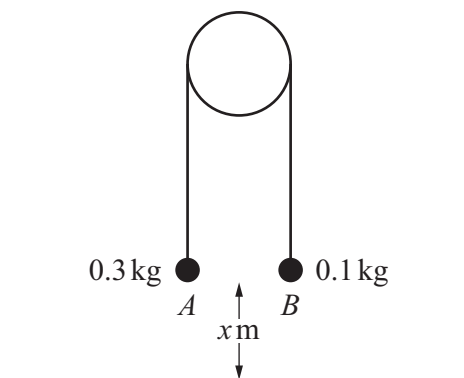
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Two particles A and B have masses 0.3 kg and 0.1 kg respectively. The particles are attached to the ends of a light inextensible string. The string passes over a fixed smooth pulley, and the particles hang vertically below the pulley. Both particles are initially at a height of $x\text{ m}$ above horizontal ground (see diagram). The system is released from rest.

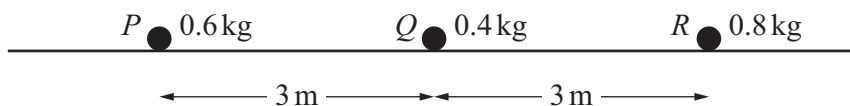
- (a) Find the tension in the string and the acceleration of the particles. [4]

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(b) Given that the greatest height of B above the ground is 1.2 m, find the value of x . [3]

[illegible]



Three particles P , Q and R , of masses 0.6 kg , 0.4 kg and 0.8 kg respectively, are at rest in a straight line on a smooth horizontal plane. The distance from P to Q is 3 m , and the distance from Q to R is also 3 m (see diagram). P is projected directly towards Q with speed 3 m s^{-1} . After P and Q collide, P continues to move in the same direction with speed 1.5 m s^{-1} .

- (a) Find the speed of Q after the collision.

[2]

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In the subsequent collision between Q and R , these particles coalesce.

- (b) Find the speed of the combined particle after this collision.

[1]

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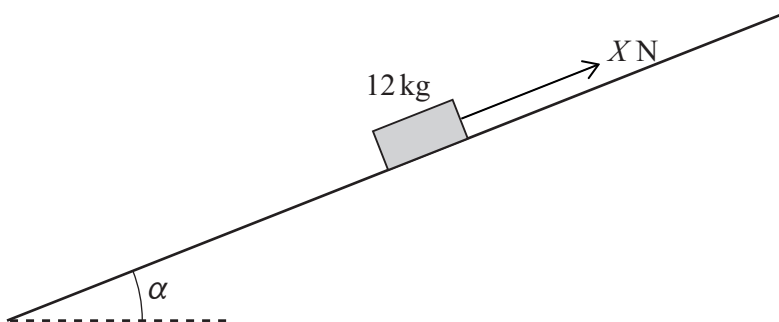
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- [illegible]



(a) It is given that $\mu = 0.15$ and $X = 20$.

[6]

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- Find the value of μ and the value of X for which the block is on the point of moving **up** the plane. [4]

[illegible]

- (a) Show that $k = 3$ and $p = 26$.

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.



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 entire width of the page. There are no margins, text, or other markings present.

[illegible]





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