

Cambridge International AS & A Level

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MATHEMATICS**9709/43**

Paper 4 Mechanics

October/November 2020**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. Blank pages are indicated.

1 A particle P is projected vertically upwards with speed $v \text{ m s}^{-1}$ from a point on the ground. P reaches its greatest height after 3 s.

(a) Find v . [1]

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(b) Find the greatest height of P above the ground. [2]

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2 A box of mass 5 kg is pulled at a constant speed a distance of 15 m up a rough plane inclined at an angle of 20° to the horizontal. The box moves along a line of greatest slope against a frictional force of 40 N. The force pulling the box is parallel to the line of greatest slope.

(a) Find the work done against friction. [1]

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(b) Find the change in gravitational potential energy of the box. [2]

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(c) Find the work done by the pulling force. [1]

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3 A string is attached to a block of mass 4 kg which rests in limiting equilibrium on a rough horizontal table. The string makes an angle of 24° above the horizontal and the tension in the string is 30 N.

(a) Draw a diagram showing all the forces acting on the block. [1]

(b) Find the coefficient of friction between the block and the table. [5]

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5 A particle P moves in a straight line. It starts at a point O on the line and at time t s after leaving O it has velocity v m s⁻¹, where $v = 4t^2 - 20t + 21$.

(a) Find the values of t for which P is at instantaneous rest. [2]

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(b) Find the initial acceleration of P . [2]

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(c) Find the minimum velocity of P . [2]

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(b) The car and caravan now travel up a straight hill, inclined at an angle of $\sin^{-1} 0.05$ to the horizontal, at a constant speed of $v \text{ m s}^{-1}$. The car's engine is working at 32.5 kW.

Find v . [3]

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