

Cambridge
International
A Level

Cambridge International Examinations
Cambridge International Advanced Level

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MATHEMATICS

9709/52

Paper 5 Mechanics 2 (**M2**)

May/June 2017

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** the questions.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

Where a numerical value for the acceleration due to gravity is needed, use 10 m s^{-2} .

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is 50.

This document consists of **14** printed pages and **2** blank pages.



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1 A particle P of mass 0.2 kg moves with speed 4 m s^{-1} and angular speed 5 rad s^{-1} in a horizontal circle on a smooth surface. P is attached to one end of a light elastic string of natural length 0.6 m . The other end of the string is attached to the point on the surface which is the centre of the circular motion of P .

(i) Find the radius of this circle. [1]

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(ii) Find the modulus of elasticity of the string. [4]

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4 A small object of mass 0.4 kg is released from rest at a point 8 m above the ground. The object descends vertically and when its downwards displacement from its initial position is x m the object has velocity v m s⁻¹. While the object is moving, a force of magnitude $0.2v^2$ N opposes the motion.

(i) Show that $v \frac{dv}{dx} = 10 - 0.5v^2$. [2]

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(ii) Express v in terms of x . [4]

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(iii) Find the increase in the value of v during the final 4 m of the descent of the object. [2]

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The 3 N force is removed, and the rod is held in equilibrium by a force of magnitude P N applied at B , acting in the vertical plane containing the rod, at an angle of 30° below the horizontal.

(ii) Calculate P . [2]

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In one of the two situations described, the rod AB is in limiting equilibrium.

(iii) Find the coefficient of friction at A . [4]

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(iii) Find the direction of motion of P when it passes through A . [3]

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