

CANDIDATE
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MATHEMATICS

9709/51

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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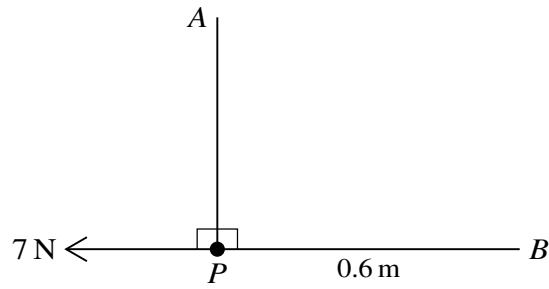


Fig. 1

One end of a light inextensible string is attached to a fixed point A . The other end of the string is attached to a particle P of mass m kg which hangs vertically below A . The particle is also attached to one end of a light elastic string of natural length 0.25 m. The other end of this string is attached to a point B which is 0.6 m from P and on the same horizontal level as P . Equilibrium is maintained by a horizontal force of magnitude 7 N applied to P (see Fig. 1).

- (i) Calculate the modulus of elasticity of the elastic string. [2]

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The horizontal ground is at the top of a vertical cliff. The point O is at a distance d m from the edge of the cliff. The particle is projected towards the edge of the cliff and does not strike the ground before it passes over the edge of the cliff.

(ii) Show that d is less than 30. [2]

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(iii) Find the value of x when the particle is 14 m below the level of O . [2]

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7 A particle P of mass 0.5 kg is at rest at a point O on a rough horizontal surface. At time $t = 0$, where t is in seconds, a horizontal force acting in a fixed direction is applied to P . At time t s the magnitude of the force is $0.6t^2\text{ N}$ and the velocity of P away from O is $v\text{ m s}^{-1}$. It is given that P remains at rest at O until $t = 0.5$.

(i) Calculate the coefficient of friction between P and the surface, and show that

$$\frac{dv}{dt} = 1.2t^2 - 0.3 \quad \text{for } t > 0.5. \quad [3]$$

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(ii) Express v in terms of t for $t > 0.5$. [3]

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(iii) Find the displacement of P from O when $t = 1.2$. [3]

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