

CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
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MATHEMATICS

9709/52

Paper 5 Mechanics 2 (M2)

October/November 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.

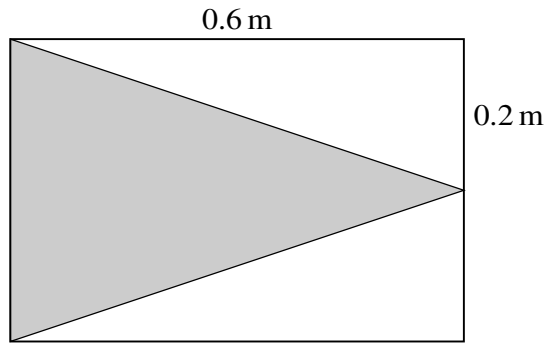
The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is 50.

This document consists of **13** printed pages and **3** blank pages.



2



A uniform solid cone has height 0.6 m and base radius 0.2 m. A uniform hollow cylinder, open at both ends, has the same dimensions. An object is made by putting the cone inside the cylinder so that the base of the cone coincides with one end of the cylinder (see diagram, which shows a cross-section). The total weight of the object is 60 N and its centre of mass is 0.25 m from the base of the cone. Calculate the weight of the cone. [3]

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- 3 A particle P of mass 0.4 kg is released from rest at a point O on a smooth plane inclined at 30° to the horizontal. P moves down the line of greatest slope through O . The velocity of P is $v\text{ m s}^{-1}$ when its displacement from O is $x\text{ m}$. A retarding force of magnitude $0.2v^2\text{ N}$ acts on P in the direction PO .

(i) Show that $v \frac{dv}{dx} = 5 - 0.5v^2$. [2]

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

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A series of 25 horizontal dotted lines for writing.

7 A small ball B is projected from a point O which is h m above a horizontal plane. At time 2 s after projection B has speed 18 m s^{-1} and is moving in the direction 30° above the horizontal.

(i) Find the initial speed and the angle of projection of B . [4]

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B has speed 38 m s^{-1} immediately before it strikes the plane.

(ii) Calculate h . [2]

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