

CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

MATHEMATICS

9709/42

Paper 4 Mechanics 1 (**M1**)

February/March 2018

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 in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.

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 **12** printed pages.



5 A small rocket is fired vertically upwards, starting from rest at ground level, and moves with constant acceleration. The rocket reaches a height of 200 m after 10 s.

(i) Show that the speed of the rocket after 10 s is 40 m s^{-1} and find the acceleration of the rocket during the first 10 s. [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) After 10 s, the rocket’s fuel stops burning and there is no upward force acting on the rocket. Find the maximum height above ground level reached by the rocket. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (iii)** The car travels at a constant speed up a hill inclined at an angle of $\sin^{-1}\left(\frac{7}{48}\right)$ to the horizontal. Find the greatest possible speed of the car. [5]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

7 A particle P moves in a straight line. The velocity $v \text{ m s}^{-1}$ at time $t \text{ s}$ is given by

$$v = 4 + 0.2t \quad \text{for } 0 \leq t \leq 10,$$

$$v = -2 + \frac{800}{t^2} \quad \text{for } 10 \leq t \leq 20.$$

(i) Find the acceleration of P during the first 10 s. [1]

.....

.....

.....

.....

(ii) Find the acceleration of P when $t = 20$. [2]

.....

.....

.....

.....

.....

.....

(iii) Sketch the velocity-time graph for $0 \leq t \leq 20$. [3]

Additional Page

If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.