



Cambridge Assessment International Education

Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	
MATHEMATICS			9709/41
Paper 4 Mechanics	1 (M1)		May/June 2019
			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.

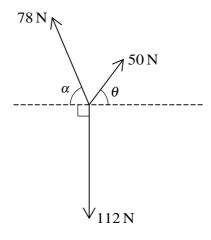
At the end of the examination, fasten all your work securely together.

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.



BLANK PAGE



Given that $\tan \alpha = \frac{12}{5}$ and $\tan \theta = \frac{4}{3}$, show that the coplanar forces shown in the diagram are in equilibrium.	n]
	•
	•
	· •
	•
	•
	•
	•
	•
	•
	. .
	· •

A particle P is projected vertically upwards with speed $25 \,\mathrm{m\,s^{-1}}$ from a point $3 \,\mathrm{m}$ above horizontal

(i)	Find the time taken for P to reach its greatest height.	[
		•••••
		••••••
		••••••
(ii)	Find the length of time for which P is higher than 23 m above the ground.	
		••••••
		••••••

		•••••
·••\		
(111)	P is higher than h m above the ground for 1 second. Find h .	[2]
(111)	P is higher than h m above the ground for 1 second. Find h .	[2]
(III)		[2]
(111)		[2]
111)		[2]
(111)		[2]
(III)		
m)		
m)		
(iii)		
<u>m)</u>		
(iii)		

3	A lorry	has mass	12000 kg.

(i)	The lorry moves at a constant speed of 5 m s ⁻¹ up a hill inclined at an angle of θ to the horizontal where $\sin \theta = 0.08$. At this speed, the magnitude of the resistance to motion on the lorry is 1500 N. Show that the power of the lorry's engine is 55.5 kW.

When the speed of the lorry is $v \,\mathrm{m\,s^{-1}}$ the magnitude of the resistance to motion is $kv^2 \,\mathrm{N}$, where k is a constant.

(ii)	Show that $k = 60$.	[1]
(iii)	The lorry now moves at a constant speed on a straight level r working at 55.5 kW, find the lorry's speed.	[3]

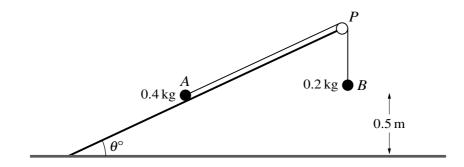
A particle of mass 1.3 kg rests on a rough plane inclined at an angle θ to the horizontal, where

A force of magnitude 20 N parallel to a line of greatest slope of the plane is applied to the parallel and the particle is on the point of moving up the plane. Show that $\mu = 1.6$.

The force of magnitude 20 N is now removed.

••••••	•••••	•••••		•••••		•••••	•••••
	•••••						
••••••	•••••	•••••		•••••		•••••	•••••
••••••	•••••	••••••	•••••••	••••••	••••••	••••••	••••••
		•••••					
	•••••	•••••		•••••			
•••••	•••••			•••••			•••••
•••••	•••••	••••••	••••••	•••••	• • • • • • • • • • • • • • • • • • • •	•••••	••••••
Find t	the work don	e against f	riction duri	ng the first	2 s of motion	1.	
Find t	the work don	e against f	riction duri	ng the first	2 s of motion	1.	
Find t	the work don	e against f	riction duri	ng the first	2 s of motion	1.	
Find t	the work don	e against f	riction duri	ng the first	2 s of motion	1.	
Find t	the work don	e against f	riction duri	ng the first	2 s of motion	1.	
Find t	the work don	e against f	riction duri	ng the first	2 s of motion	1.	
Find t	the work don	e against f	riction duri	ng the first	2 s of motion	1.	
Find (the work don	e against f	riction duri	ng the first	2 s of motion	1.	

	$v = t^2 - 8t + 12$ for $0 \le t \le 8$.	
(i)	Find the minimum velocity of P .	[3]
ii)	Find the total distance travelled by <i>P</i> in the interval $0 \le t \le 8$.	[7



Two particles A and B, of masses 0.4 kg and 0.2 kg respectively, are connected by a light inextensible string. Particle A is held on a smooth plane inclined at an angle of θ° to the horizontal. The string passes over a small smooth pulley P fixed at the top of the plane, and B hangs freely 0.5 m above horizontal ground (see diagram). The particles are released from rest with both sections of the string taut.

(i)	Given that the system is in equilibrium, find θ .	[3]

(a)	Find the tension in the string and the acceleration of the system.	[4
(b)	Find the speed of A at the instant B reaches the ground.	[2
(U)		
(<i>v)</i>		
(D)		
(<i>D)</i>		
(<i>D)</i>		
(<i>D)</i>		
(<i>u)</i>		

[Question 6 continues on the next page.]

ir	istantaneous rest.
••	
•	
•	
•	
••	
••	

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.

BLANK PAGE

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 Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

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