

Centre No.						Paper Reference						Surname	Initial(s)	
Candidate No.						6	6	7	8	/	0	1	Signature	

Paper Reference(s)

6678/01

Edexcel GCE

Mechanics M2

Advanced/Advanced Subsidiary

Friday 25 January 2013 – Afternoon

Time: 1 hour 30 minutes

Examiner's use only

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Team Leader's use only

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Materials required for examination

Mathematical Formulae (Pink)

Items included with question papers

Nil

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation or symbolic differentiation/integration, or have retrievable mathematical formulae stored in them.

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
Total	

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature. Check that you have the correct question paper.
Answer ALL the questions.
You must write your answer to each question in the space following the question.
Whenever a numerical value of g is required, take $g = 9.8 \text{ m s}^{-2}$.
When a calculator is used, the answer should be given to an appropriate degree of accuracy.

Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.
Full marks may be obtained for answers to ALL questions.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. (2).
There are 7 questions in this question paper. The total mark for this paper is 75.
There are 28 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You must show sufficient working to make your methods clear to the examiner.
Answers without working may not gain full credit.

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Turn over



1. Two uniform rods AB and BC are rigidly joined at B so that $\angle ABC = 90^\circ$. Rod AB has length 0.5 m and mass 2 kg. Rod BC has length 2 m and mass 3 kg. The centre of mass of the framework of the two rods is at G .

(a) Find the distance of G from BC .

(2)

The distance of G from AB is 0.6 m.

The framework is suspended from A and hangs freely in equilibrium.

(b) Find the angle between AB and the downward vertical at A .

(3)



3.

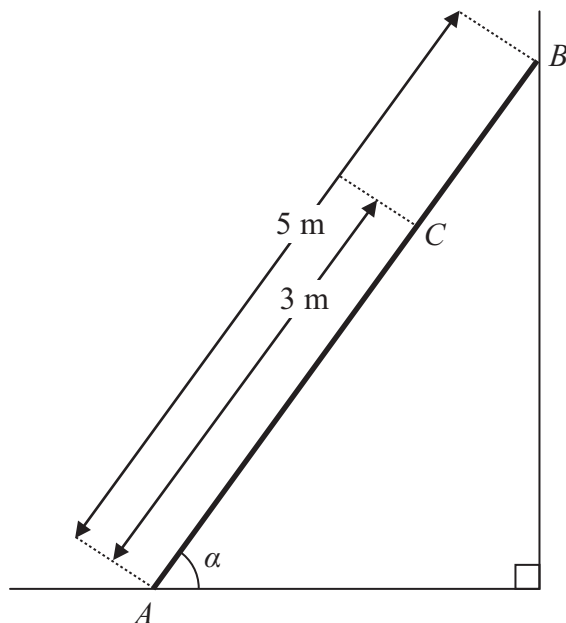


Figure 1

A ladder, of length 5 m and mass 18 kg, has one end A resting on rough horizontal ground and its other end B resting against a smooth vertical wall. The ladder lies in a vertical plane perpendicular to the wall and makes an angle α with the horizontal ground, where $\tan \alpha = \frac{4}{3}$, as shown in Figure 1. The coefficient of friction between the ladder and the ground is μ . A woman of mass 60 kg stands on the ladder at the point C , where $AC = 3$ m. The ladder is on the point of slipping. The ladder is modelled as a uniform rod and the woman as a particle.

Find the value of μ .

(9)



5. The point A lies on a rough plane inclined at an angle θ to the horizontal, where $\sin \theta = \frac{24}{25}$. A particle P is projected from A , up a line of greatest slope of the plane, with speed $U \text{ m s}^{-1}$. The mass of P is 2 kg and the coefficient of friction between P and the plane is $\frac{5}{12}$. The particle comes to instantaneous rest at the point B on the plane, where $AB = 1.5 \text{ m}$. It then moves back down the plane to A .

(a) Find the work done against friction as P moves from A to B . (4)

(b) Use the work-energy principle to find the value of U . (4)

(c) Find the speed of P when it returns to A . (3)



Question 5 continued

Handwriting practice lines consisting of 28 horizontal lines for writing.



6.

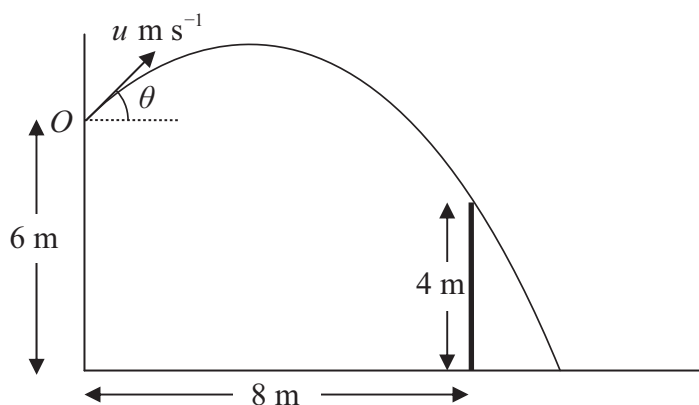


Figure 2

A ball is thrown from a point O , which is 6 m above horizontal ground. The ball is projected with speed $u \text{ m s}^{-1}$ at an angle θ above the horizontal. There is a thin vertical post which is 4 m high and 8 m horizontally away from the vertical through O , as shown in Figure 2. The ball passes just above the top of the post 2 s after projection. The ball is modelled as a particle.

(a) Show that $\tan \theta = 2.2$ (5)

(b) Find the value of u . (2)

The ball hits the ground T seconds after projection.

(c) Find the value of T . (3)

Immediately before the ball hits the ground the direction of motion of the ball makes an angle α with the horizontal.

(d) Find α . (5)



