

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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5	
6	
7	
TOTAL	



General Certificate of Education  
Advanced Level Examination  
June 2011

# Mathematics

# MM03

## Unit Mechanics 3

Wednesday 22 June 2011 9.00 am to 10.30 am

**For this paper you must have:**

- the blue AQA booklet of formulae and statistical tables.

You may use a graphics calculator.

### Time allowed

- 1 hour 30 minutes

### Instructions

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Write the question part reference (eg (a), (b)(i) etc) in the left-hand margin.
- You must answer the questions in the spaces provided. Do not write outside the box around each page.
- Show all necessary working; otherwise marks for method may be lost.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- The **final** answer to questions requiring the use of calculators should be given to three significant figures, unless stated otherwise.
- Take  $g = 9.8 \text{ m s}^{-2}$ , unless stated otherwise.

### Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.

### Advice

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.



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QUESTION  
PART  
REFERENCE

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QUESTION  
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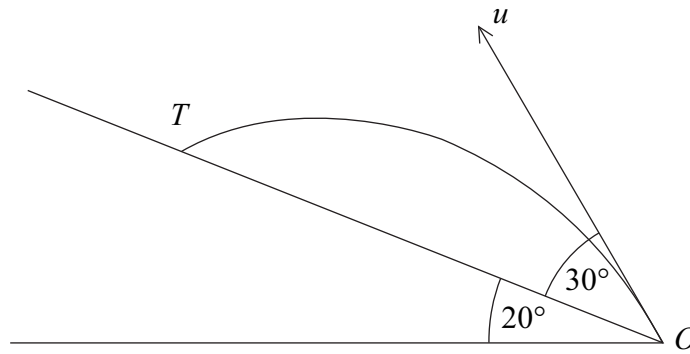




6

A projectile is fired from a point  $O$  on a plane which is inclined at an angle of  $20^\circ$  to the horizontal. The projectile is fired up the plane with velocity  $u \text{ m s}^{-1}$  at an angle of  $30^\circ$  to the inclined plane. The projectile travels in a vertical plane containing a line of greatest slope of the inclined plane.

The projectile hits a target  $T$  on the inclined plane.



(a) Given that  $OT = 200 \text{ m}$ , determine the value of  $u$ . (7 marks)

(b) Find the greatest perpendicular distance of the projectile from the inclined plane. (4 marks)

QUESTION  
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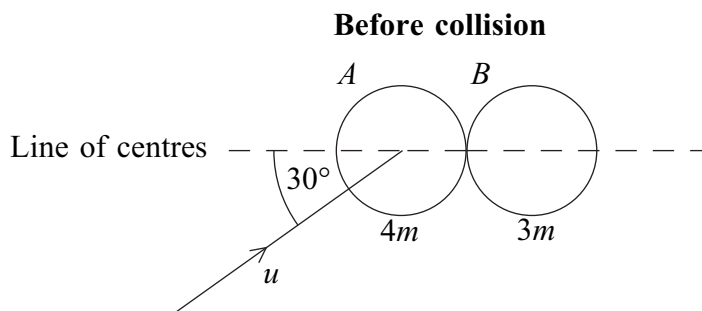
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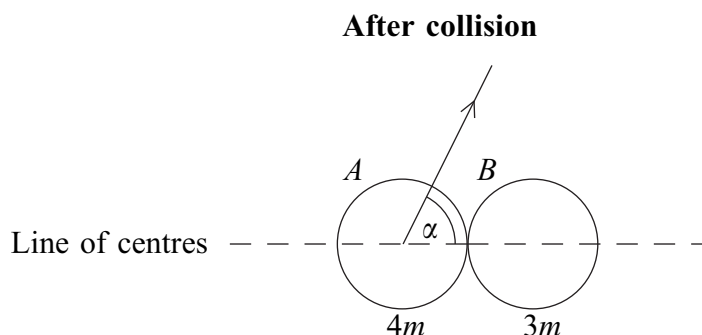
7

Two smooth spheres,  $A$  and  $B$ , have equal radii and masses  $4m$  and  $3m$  respectively. The sphere  $A$  is moving on a smooth horizontal surface and collides with the sphere  $B$ , which is stationary on the same surface.

Just before the collision,  $A$  is moving with speed  $u$  at an angle of  $30^\circ$  to the line of centres, as shown in the diagram below.



Immediately after the collision, the direction of motion of  $A$  makes an angle  $\alpha$  with the line of centres, as shown in the diagram below.



The coefficient of restitution between the spheres is  $\frac{5}{9}$ .

- (a) Find the value of  $\alpha$ . (10 marks)
- (b) Find, in terms of  $m$  and  $u$ , the magnitude of the impulse exerted on  $B$  during the collision. (3 marks)

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QUESTION  
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REFERENCE

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QUESTION  
PART  
REFERENCE

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**END OF QUESTIONS**



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ANSWER IN THE SPACES PROVIDED**

