

Centre Number						Candidate Number				
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Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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8	
9	
TOTAL	



General Certificate of Education  
Advanced Level Examination  
June 2015

# Mathematics

# MM2B

## Unit Mechanics 2B

Monday 22 June 2015 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 each question in the space provided for that question. If you require extra space, use an AQA supplementary answer book; do **not** use the space provided for a different question.
- 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.
- You do not necessarily need to use all the space provided.



J U N 1 5 M M 2 B 0 1

Answer **all** questions.

Answer each question in the space provided for that question.

**1** A particle, of mass 4 kg, moves in a horizontal plane under the action of a single force, **F** newtons. The unit vectors **i** and **j** are in the horizontal plane, perpendicular to each other.

At time  $t$  seconds, the velocity of the particle,  $v \text{ m s}^{-1}$ , is given by

$$v = 4 \cos 2t \mathbf{i} + 3 \sin t \mathbf{j}$$

**(a) (i)** Find an expression for the force, **F**, acting on the particle at time  $t$  seconds. **[3 marks]**

**(ii)** Find the magnitude of **F** when  $t = \pi$ . **[2 marks]**

**(b)** When  $t = 0$ , the particle is at the point with position vector  $(2\mathbf{i} - 14\mathbf{j})$  metres. Find the position vector, **r** metres, of the particle at time  $t$  seconds. **[5 marks]**

QUESTION  
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QUESTION  
PART  
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QUESTION  
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REFERENCE

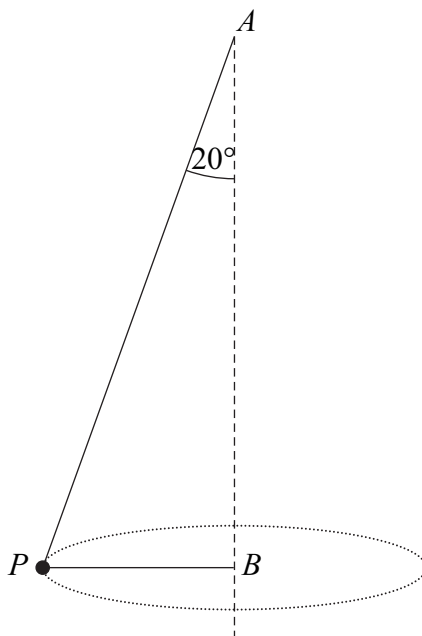
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- 4 A particle,  $P$ , of mass  $5\text{ kg}$  is attached to two light inextensible strings,  $AP$  and  $BP$ . The other ends of the strings are attached to the fixed points  $A$  and  $B$ . The point  $A$  is vertically above the point  $B$ . The particle moves at a constant speed,  $v\text{ m s}^{-1}$ , in a horizontal circle of radius  $0.6\text{ metres}$  with centre  $B$ . The string  $AP$  is inclined at  $20^\circ$  to the vertical, as shown in the diagram. Both strings are taut when the particle is moving.



- (a) Find the tension in the string  $AP$ . [3 marks]

- (b) The speed of the particle is  $v\text{ m s}^{-1}$ .

Show that the tension,  $T_{BP}$ , in the string  $BP$  is given by

$$T_{BP} = \frac{25}{3}v^2 - 5g \tan 20^\circ$$

[3 marks]

- (c) Find  $v$  when the tensions in the two strings are equal.

[4 marks]

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QUESTION  
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QUESTION  
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QUESTION  
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REFERENCE

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QUESTION  
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QUESTION  
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QUESTION  
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**END OF QUESTIONS**



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ANSWER IN THE SPACES PROVIDED**

