

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Education
Advanced Subsidiary Examination
June 2012

Mathematics

MM1B

Unit Mechanics 1B

Thursday 24 May 2012 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.
- Unit Mechanics 1B has a **written paper only**.

Advice

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- You do not necessarily need to use all the space provided.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	



J U N 1 2 M M 1 B 0 1

Answer **all** questions.

Answer each question in the space provided for that question.

- 1** As a boat moves, it travels at 5 m s^{-1} due north, relative to the water. The water is moving due west at 2 m s^{-1} .
- (a) Find the magnitude of the resultant velocity of the boat. (2 marks)
- (b) Find the bearing of the resultant velocity of the boat. (3 marks)

QUESTION
PART
REFERENCE

Answer space for question 1



QUESTION
PART
REFERENCE**Answer space for question 1****Turn over ►**

2

Two toy trains, A and B , are moving in the same direction on a straight horizontal track when they collide. As they collide, the speed of A is 4 m s^{-1} and the speed of B is 3 m s^{-1} . Immediately after the collision, they move together with a speed of 3.8 m s^{-1} .

The mass of A is 2 kg . Find the mass of B .

(3 marks)

QUESTION
PART
REFERENCE

Answer space for question 2



QUESTION
PART
REFERENCE

Answer space for question 2

Handwriting practice area with horizontal dotted lines.



3 A car is travelling at a speed of 20 m s^{-1} along a straight horizontal road. The driver applies the brakes and a constant braking force acts on the car until it comes to rest.

(a) Assume that no other horizontal forces act on the car.

(i) After the car has travelled 75 metres, its speed has reduced to 10 m s^{-1} . Find the acceleration of the car. *(3 marks)*

(ii) Find the time taken for the speed of the car to reduce from 20 m s^{-1} to zero. *(2 marks)*

(iii) Given that the mass of the car is 1400 kg, find the magnitude of the constant braking force. *(2 marks)*

(b) Given that a constant air resistance force of magnitude 200 N acts on the car during the motion, find the magnitude of the constant braking force. *(1 mark)*

QUESTION
PART
REFERENCE

Answer space for question 3



QUESTION
PART
REFERENCE**Answer space for question 3****Turn over ►**

- (a) Find θ . (3 marks)
- (b) Find W . (2 marks)
- (c) Calculate the mass of the particle. (2 marks)

QUESTION	PART	REFERENCE
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Answer space for question 4

[illegible]

QUESTION
PART
REFERENCE

Answer space for question 4

Handwriting practice area with horizontal dotted lines.

Turn over ►



Diagram of a block and pulley system. A 12 kg block is on a horizontal surface, connected by a string that runs horizontally to the right, passes over a pulley at the edge, and then hangs vertically down to an 18 kg mass.

(a) Assuming that the surface is smooth, use two equations of motion to find the magnitude of the acceleration of the block and particle. (4 marks)

(b) In reality, the surface is rough and the acceleration of the block is 3 m s^{-2} .

(i) Find the tension in the string. (3 marks)

(ii) Calculate the magnitude of the normal reaction force acting on the block. (1 mark)

(iii) Find the coefficient of friction between the block and the surface. (5 marks)

(c) State two modelling assumptions, other than those given, that you have made in answering this question. (2 marks)

Answer space for question 5

[illegible]

Answer space for question 5

[illegible]

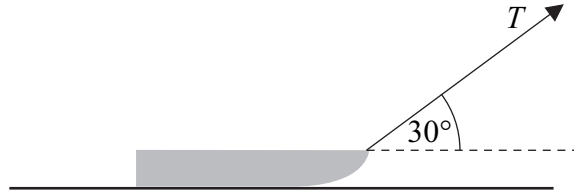
Answer space for question 5

This image shows a full page of primary-ruled paper. It features a vertical solid line on the left side, creating a narrow margin. The rest of the page is filled with horizontal dashed lines, providing a guide for letter height and placement. There are no pre-written words or numbers on the page.

Answer space for question 5

This image shows a full page of primary-ruled paper. It features a vertical solid line on the left side, creating a narrow margin. The rest of the page is filled with horizontal dashed lines, providing a guide for handwriting practice. There are no other markings or text on the page.

A child pulls a sledge, of mass 8 kg, along a rough horizontal surface, using a light rope. The coefficient of friction between the sledge and the surface is 0.3. The tension in the rope is T newtons. The rope is kept at an angle of 30° to the horizontal, as shown in the diagram.



(a) Draw a diagram to show all the forces acting on the sledge. *(1 mark)*

(b) Find the magnitude of the normal reaction force acting on the sledge, in terms of T . *(3 marks)*

(c) Given that the sledge accelerates at 0.05 m s^{-2} , find T . *(6 marks)*

Answer space for question 6

[illegible]

Answer space for question 6

[illegible]

Answer space for question 6

This image shows a full page of primary-ruled paper. It features a vertical solid line on the left side, creating a narrow margin. The rest of the page is filled with horizontal dashed lines, providing a guide for letter height and placement. There are no pre-written words or numbers on the page.

QUESTION
PART
REFERENCE**Answer space for question 6****Turn over ►**

- 7** A particle moves with a constant acceleration of $(0.1\mathbf{i} - 0.2\mathbf{j}) \text{ m s}^{-2}$. It is initially at the origin where it has velocity $(-\mathbf{i} + 3\mathbf{j}) \text{ m s}^{-1}$. The unit vectors $\mathbf{i}$ and $\mathbf{j}$ are directed east and north respectively.
- (a) Find an expression for the position vector of the particle t seconds after it has left the origin. (2 marks)
- (b) Find the time that it takes for the particle to reach the point where it is due east of the origin. (3 marks)
- (c) Find the speed of the particle when it is travelling south-east. (6 marks)

QUESTION
PART
REFERENCE

Answer space for question 7



Answer space for question 7

This image shows a full page of primary-ruled paper. It features a vertical solid line on the left side, creating a narrow margin. The rest of the page is filled with horizontal dashed lines, providing a guide for letter height and placement. There are no other markings or text on the page.

Answer space for question 7

This image shows a blank sheet of white paper designed for writing. It features a series of evenly spaced horizontal blue lines across its entire width. A single vertical red line runs down the left side, creating a narrow margin. The paper is otherwise completely empty, with no text or markings.

Answer space for question 7

This image shows a full page of primary-ruled paper. It features a vertical solid line on the left side, creating a narrow margin. The rest of the page is filled with horizontal dashed lines, providing a guide for letter height in handwriting practice. There are no markings or text on the page.

Answer space for question 8

This image shows a blank sheet of white paper designed for handwriting practice or primary-level writing. It features a solid black vertical line on the left side, creating a narrow margin. The rest of the page is filled with evenly spaced, horizontal dashed lines. There are no other markings, text, or illustrations on the page.

Answer space for question 8

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