

Please write clearly in block capitals.

Centre number

Candidate number

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

INTERNATIONAL A-LEVEL FURTHER MATHEMATICS

(9665/FM05) Unit FM2 Mechanics

Thursday 12 June 2025 07:00 GMT Time allowed: 1 hour 30 minutes

Materials

- For this paper you must have the OxfordAQA Booklet of Formulae and Statistical Tables (enclosed).
- You may use a graphical calculator.

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.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- The **final** answer to questions requiring the use of calculators should be given to two significant figures, unless stated otherwise.
- Unless stated otherwise, the acceleration due to gravity, g , should be taken as 9.8 m s^{-2}

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.

Advice

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- Show all necessary working; otherwise marks may be lost.

| For Examiner's Use | |
|--------------------|------|
| Question | Mark |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| TOTAL | |



Answer **all** questions in the spaces provided.

1 Two particles A and B are moving on a smooth horizontal surface.

The two particles collide.

Particle A has mass 2 kg and before the collision has velocity $\begin{bmatrix} 4 \\ 7 \end{bmatrix} \text{ m s}^{-1}$

Particle B has mass m kg and before the collision has velocity $\begin{bmatrix} -2 \\ -4 \end{bmatrix} \text{ m s}^{-1}$

After the collision particle A has velocity $\begin{bmatrix} 2 \\ 1 \end{bmatrix} \text{ m s}^{-1}$

After the collision particle B has velocity $\begin{bmatrix} k \\ 0 \end{bmatrix} \text{ m s}^{-1}$ where k is a constant.

1 (a) Find the value of m

[2 marks]

Answer _____

1 (b) Find the value of k

[2 marks]

Answer _____



1 (c) Find the magnitude of the impulse exerted on A by B during the collision.

Give your answer in an exact form.

[3 marks]

Answer _____

7

Turn over for the next question

Turn over ►



2 A light elastic string has modulus of elasticity 80 newtons and natural length 1.6 metres.

One end of the string is attached to a fixed point O

A particle of mass 5 kg is attached to the other end of the string.

2 (a) Find the extension of the string when the particle hangs in equilibrium vertically below O **[2 marks]**

Answer _____

2 (b) The particle is pulled down and held at the point Y
The point Y is 4 metres vertically below O

2 (b) (i) Find the elastic potential energy of the string. **[2 marks]**

Answer _____



3 (b) Find the value of β

Give your answer to the nearest degree.

[2 marks]

Answer _____

3 (c) Find the magnitude of the impulse exerted on the disc by the wall.

Give your answer in the form $\frac{\sqrt{n}}{p}$ where n is an integer and p is a prime.

[3 marks]

Answer _____



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Answer _____

6

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ANSWER IN THE SPACES PROVIDED**

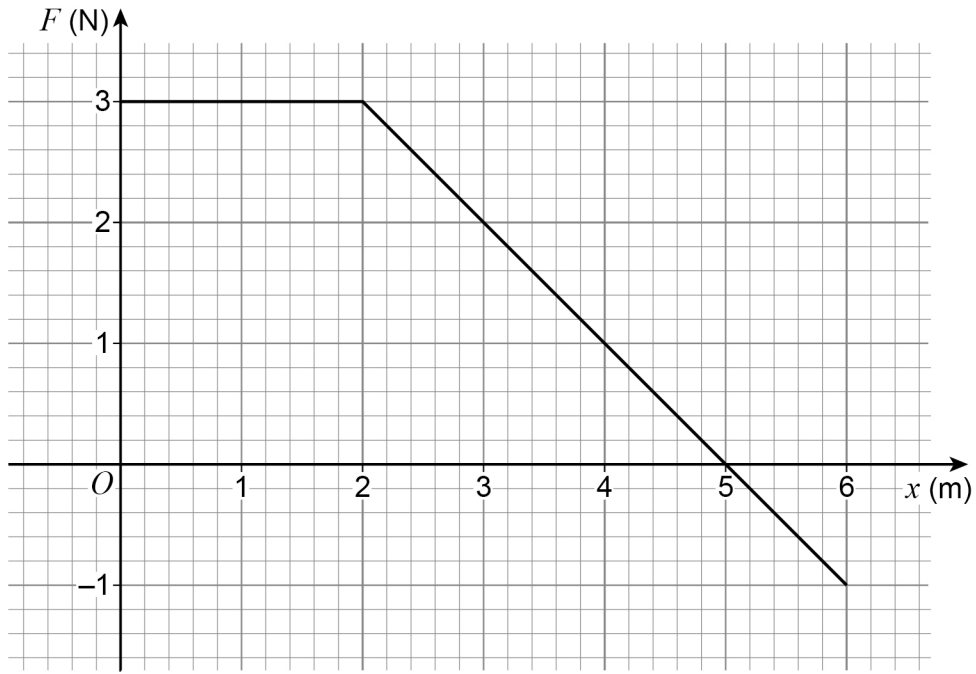
Turn over ►



6 A particle is moving on a straight line.

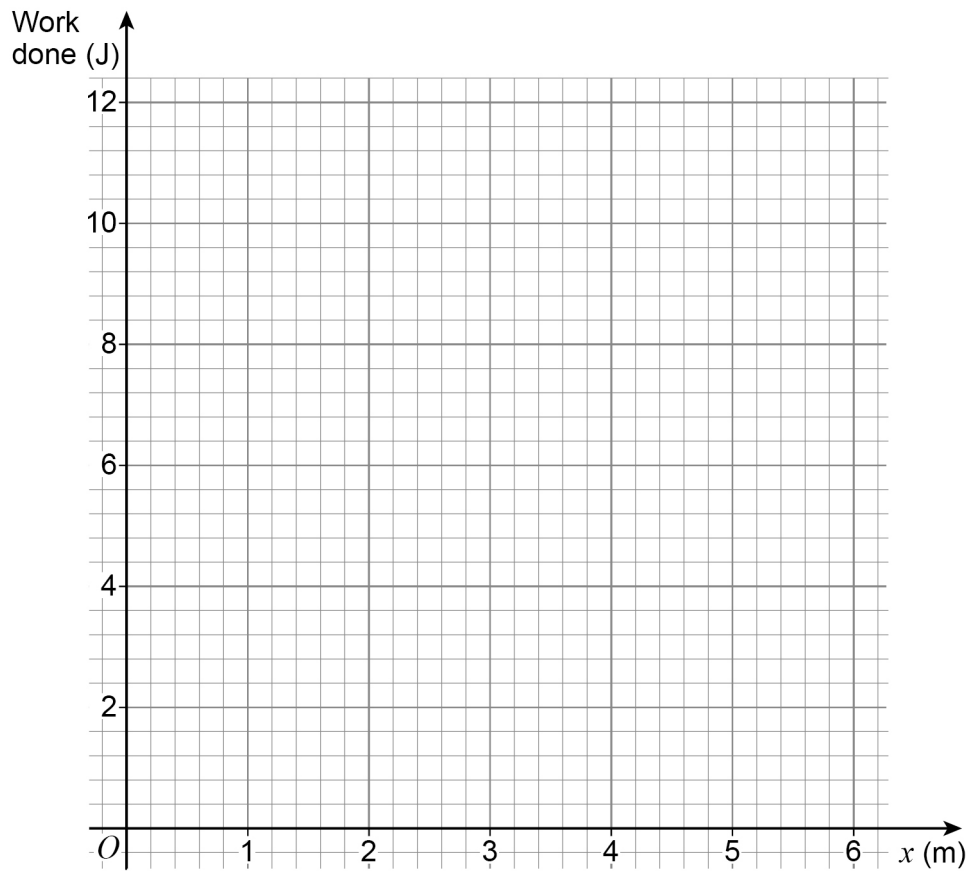
A force F newtons acts on the particle, parallel to the straight line.

The graph shows how the force F newtons varies as the displacement x metres of the particle increases from 0 to 6 metres.



On the axes below sketch a graph to show how the work done by the force F newtons varies as the displacement x metres of the particle increases from 0 to 6 metres.

[4 marks]



4

Turn over for the next question

Turn over ►



8

A plane is inclined at an angle α to the horizontal.

A ball is projected **up** the plane from a point A on the plane.

The initial velocity of the ball is $u \text{ m s}^{-1}$ at an angle θ above the plane.

The ball hits the plane for the first time at the point B

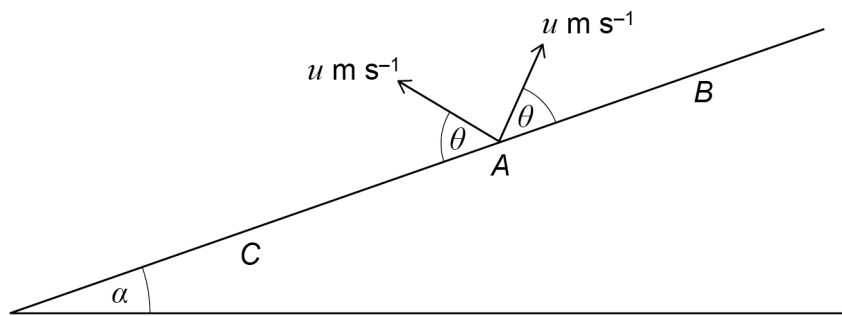
A second ball is projected **down** the plane from the point A

The initial velocity of this ball is $u \text{ m s}^{-1}$ at an angle θ above the plane.

The second ball hits the plane for the first time at the point C

The straight line CAB is a line of greatest slope of the plane.

The points A , B and C and the initial velocities are shown in the diagram.



Find the greatest possible distance between the points B and C

Give your answer in terms of u , g and α

[8 marks]



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ANSWER IN THE SPACES PROVIDED**



