

6677/01

Edexcel GCE

Mechanics M1

Advanced/Advanced Subsidiary

Friday 22 May 2009 – Morning

Time: 1 hour 30 minutes

Examiner's use only

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Team Leader's use only

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[illegible]

Mathematical Formulae (Orange or Green)

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, differentiation and integration, or have retrievable mathematical formulae stored in them.

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.

If you need more space to complete your answer to any question, use additional answer sheets.

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.

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 8 questions in this question paper. The total mark for this paper is 75.

There are 24 pages in this question paper. Any blank pages are indicated.

You must ensure that your answers to parts of questions are clearly labelled.

You should show sufficient working to make your methods clear to the Examiner.

Answers without working may not gain full credit.

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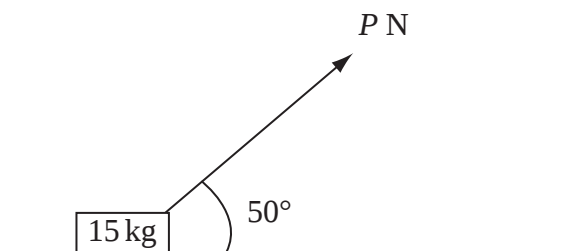
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(3)

This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal grey lines across its entire width, providing a guide for handwriting or typing. The paper itself is a clean, off-white color.

(9)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

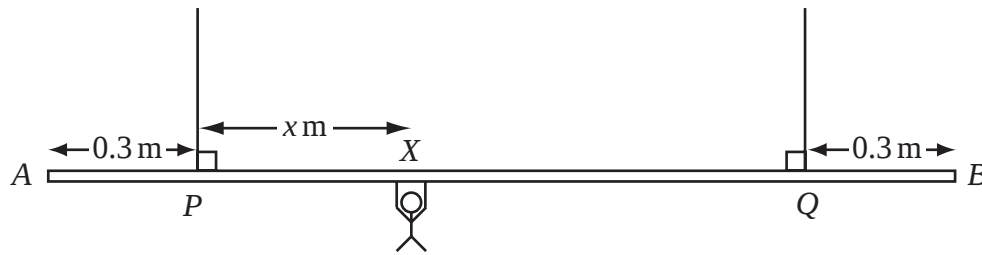


A small box of mass 15 kg rests on a rough horizontal plane. The coefficient of friction between the box and the plane is 0.2. A force of magnitude P newtons is applied to the box at 50° to the horizontal, as shown in Figure 1. The box is on the point of sliding along the plane.

Find the value of P , giving your answer to 2 significant figures.

(9)

Leave
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A beam AB is supported by two vertical ropes, which are attached to the beam at points P and Q , where $AP = 0.3$ m and $BQ = 0.3$ m. The beam is modelled as a uniform rod, of length 2 m and mass 20 kg. The ropes are modelled as light inextensible strings. A gymnast of mass 50 kg hangs on the beam between P and Q . The gymnast is modelled as a particle attached to the beam at the point X , where $PX = x$ m, $0 < x < 1.4$ as shown in Figure 2. The beam rests in equilibrium in a horizontal position.

- Given that the tension in the rope attached at Q is three times the tension in the rope attached at P ,

- (d) find the value of x . (3)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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blank**Question 7 continued**

8. [In this question $\mathbf{i}$ and $\mathbf{j}$ are horizontal unit vectors due east and due north respectively.]

A hiker H is walking with constant velocity $(1.2\mathbf{i} - 0.9\mathbf{j}) \text{ m s}^{-1}$.

- (a) Find the speed of H .

(2)

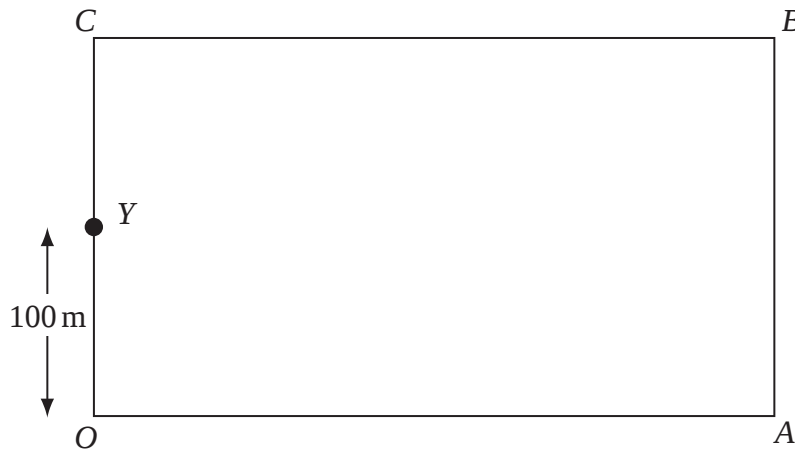


Figure 3

A horizontal field $OABC$ is rectangular with OA due east and OC due north, as shown in Figure 3. At twelve noon hiker H is at the point Y with position vector $100\mathbf{j} \text{ m}$, relative to the fixed origin O .

- (b) Write down the position vector of H at time t seconds after noon.

(2)

At noon, another hiker K is at the point with position vector $(9\mathbf{i} + 46\mathbf{j}) \text{ m}$. Hiker K is moving with constant velocity $(0.75\mathbf{i} + 1.8\mathbf{j}) \text{ m s}^{-1}$.

- (c) Show that, at time t seconds after noon,

$$\overrightarrow{HK} = [(9 - 0.45t)\mathbf{i} + (2.7t - 54)\mathbf{j}] \text{ metres.}$$

(4)

Hence,

- (d) show that the two hikers meet and find the position vector of the point where they meet.

(5)



Leave
blank**Question 8 continued****Q8****(Total 13 marks)****TOTAL FOR PAPER: 75 MARKS****END**