

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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Pearson Edexcel International Advanced Level

Time 1 hour 30 minutes

Paper
reference

WME01/01

Mathematics

International Advanced Subsidiary/Advanced Level Mechanics M1

You must have:

Mathematical Formulae and Statistical Tables (Yellow), calculator

Total Marks

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Whenever a numerical value of g is required, take $g = 9.8 \text{ m s}^{-2}$, and give your answer to either 2 significant figures or 3 significant figures.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 8 questions in this question paper. The total mark for this paper is 75.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over ►

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Question 1 continued

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Q1

(Total 5 marks)



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2.



Figure 1

A uniform rod AB has length $2a$ and mass M . The rod is held in equilibrium in a horizontal position by two vertical light strings which are attached to the rod at C and D ,

where $AC = \frac{2}{5}a$ and $DB = \frac{3}{5}a$, as shown in Figure 1.

A particle P is placed on the rod at B .

The rod remains horizontal and in equilibrium.

(a) Find, in terms of M , the largest possible mass of the particle P (3)

Given that the mass of P is $\frac{1}{2}M$

(b) find, in terms of M and g , the tension in the string that is attached to the rod at C . (3)



Question 2 continued

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Question 2 continued

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Question 2 continued

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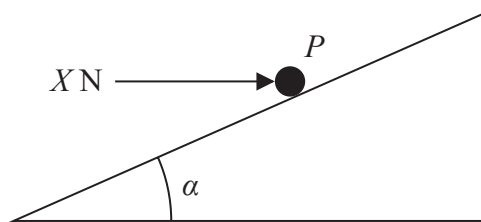
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Q2

(Total 6 marks)



3.

**Figure 2**

A rough plane is inclined to the horizontal at an angle α , where $\tan \alpha = \frac{3}{4}$

A particle P of mass 2 kg is held in equilibrium on the plane by a horizontal force of magnitude X newtons, as shown in Figure 2. The force acts in a vertical plane which contains a line of greatest slope of the inclined plane.

- (a) Show that when $X = 14.7$ there is no frictional force acting on P **(3)**

The coefficient of friction between P and the plane is 0.5

- (b) Find the smallest possible value of X . **(8)**



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Question 3 continued

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Q3

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4.

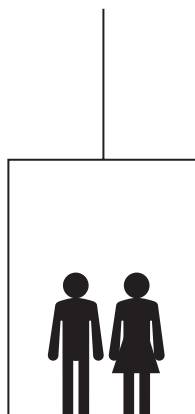


Figure 3

Two children, Alan and Bhavana, are standing on the horizontal floor of a lift, as shown in Figure 3.

The lift has mass 250 kg. The lift is raised vertically upwards with constant acceleration by a vertical cable which is attached to the top of the lift. The cable is modelled as being light and inextensible. While the lift is accelerating upwards, the tension in the cable is 3616 N.

As the lift accelerates upwards, the floor of the lift exerts a force of magnitude 565 N on Alan and a force of magnitude 226 N on Bhavana.

Air resistance is modelled as being negligible and Alan and Bhavana are modelled as particles.

(a) By considering the forces acting on the lift only, find the acceleration of the lift. (3)

(b) Find the mass of Alan. (3)

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Question 5 continued

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Question 5 continued

(Total 9 marks)

Q5

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6. [*In this question, i and j are horizontal unit vectors.*]

A particle A of mass 0.5 kg is at rest on a smooth horizontal plane.

At time $t = 0$, two forces, $\mathbf{F}_1 = (-3\mathbf{i} + 2\mathbf{j})\text{ N}$ and $\mathbf{F}_2 = (p\mathbf{i} + q\mathbf{j})\text{ N}$, where p and q are constants, are applied to A .

Given that A moves in the direction of the vector $(\mathbf{i} - 2\mathbf{j})$,

(a) show that $2p + q - 4 = 0$ (4)

Given that $p = 5$

(b) find the speed of A at time $t = 4$ seconds. (5)

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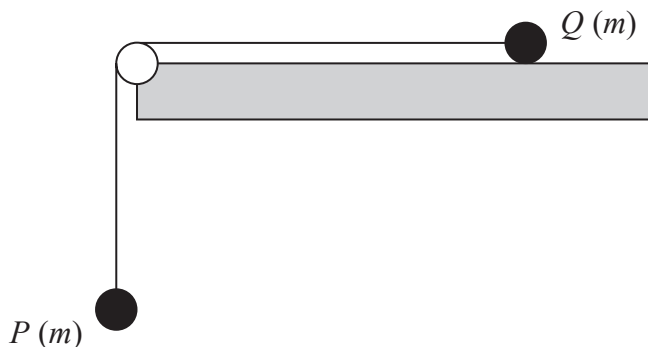


Figure 4

A particle P of mass m is attached to one end of a light inextensible string. Another particle Q , also of mass m , is attached to the other end of the string. The string passes over a small smooth pulley which is fixed at the edge of a rough horizontal table. Particle Q is held at rest on the table and particle P hangs vertically below the pulley with the string taut, as shown in Figure 4.

The pulley, P and Q all lie in the same vertical plane.

The coefficient of friction between Q and the table is μ , where $\mu < 1$

Particle Q is released from rest.

The tension in the string before Q hits the pulley is kmg , where k is a constant.

- (a) Find k in terms of μ . (7)

Given that Q is initially a distance d from the pulley,

- (b) find, in terms of d , g and μ , the time taken by Q , after release, to reach the pulley. (4)

- (c) Describe what would happen if $\mu \geq 1$, giving a reason for your answer. (2)

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Question 7 continued

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Q7

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(Total 13 marks)



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8. [In this question, \mathbf{i} and \mathbf{j} are horizontal unit vectors directed due east and due north respectively and position vectors are given relative to a fixed origin O .]

Two ships, A and B , are moving with constant velocities.

The velocity of A is $(3\mathbf{i} + 12\mathbf{j})\text{ km h}^{-1}$ and the velocity of B is $(p\mathbf{i} + q\mathbf{j})\text{ km h}^{-1}$

(a) Find the speed of A . (2)

The ships are modelled as particles.

At 12 noon, A is at the point with position vector $(-9\mathbf{i} + 6\mathbf{j})\text{ km}$ and B is at the point with position vector $(16\mathbf{i} + 6\mathbf{j})\text{ km}$.

At time t hours after 12 noon,

$$\overrightarrow{AB} = [(25 - 12t)\mathbf{i} - 9t\mathbf{j}]\text{ km}$$

(b) Find the value of p and the value of q . (7)

(c) Find the bearing of A from B when the ships are 15 km apart, giving your answer to the nearest degree. (7)

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Question 8 continued

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Question 8 continued

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