

Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson Edexcel**  
**International**  
**Advanced Level**

Centre Number

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Candidate Number

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**Tuesday 19 January 2021**

Morning (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 (Blue), 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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(Total 6 marks)

Q1



- (b) the speed of  $Q$  immediately after the collision. (3)

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Question 2 continued

Lined area for writing the answer to Question 2.

(Total 6 marks)

Q2



3.

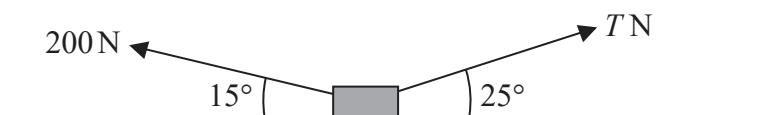


Figure 1

A parcel of mass  $20\text{ kg}$  is at rest on a rough horizontal floor. The coefficient of friction between the parcel and the floor is  $0.3$

Two forces, both acting in the same vertical plane, of magnitudes  $200\text{ N}$  and  $T\text{ N}$  are applied to the parcel. The line of action of the  $200\text{ N}$  force makes an angle of  $15^\circ$  with the horizontal and the line of action of the  $T\text{ N}$  force makes an angle of  $25^\circ$  with the horizontal, as shown in Figure 1. The parcel is modelled as a particle  $P$ .

Find the smallest value of  $T$  for which  $P$  remains in equilibrium.

(9)

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Question 3 continued

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(Total 9 marks)

Q3



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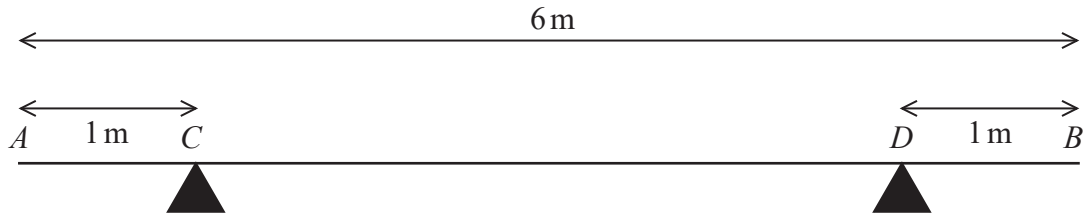


**Figure 2**

A metal girder  $AB$  has weight  $W$  newtons and length 6 m. The girder rests in a horizontal position on two supports  $C$  and  $D$  where  $AC = DB = 1$  m, as shown in Figure 2.

When a force of magnitude 900 N is applied vertically upwards to the girder at  $A$ , the girder is about to tilt about  $D$ .

When a force of magnitude 1500 N is applied vertically upwards to the girder at  $B$ , the girder is about to tilt about  $C$ .

The girder is modelled as a non-uniform rod whose centre of mass is a distance  $x$  metres from  $A$ .

Find the value of  $x$ .

(6)

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Question 4 continued

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(Total 6 marks)

Q4



5. A particle is acted upon by two forces **F** and **G**. The force **F** has magnitude 8 N and acts in a direction with a bearing of  $240^\circ$ . The force **G** has magnitude 10 N and acts due South.

Given that  $\mathbf{R} = \mathbf{F} + \mathbf{G}$ , find

- (i) the magnitude of **R**,  
(ii) the direction of **R**, giving your answer as a bearing to the nearest degree.

(7)

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Question 5 continued

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(Total 7 marks)

Q5



- (d) Find the distance between the two girls when they are closest together. (4)

Question 6 continued

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Question 6 continued

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(Total 12 marks)

Q6



- The parachutist is modelled as a particle.

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Question 7 continued

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### Question 7 continued

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Question 7 continued

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(Total 12 marks)

Q7



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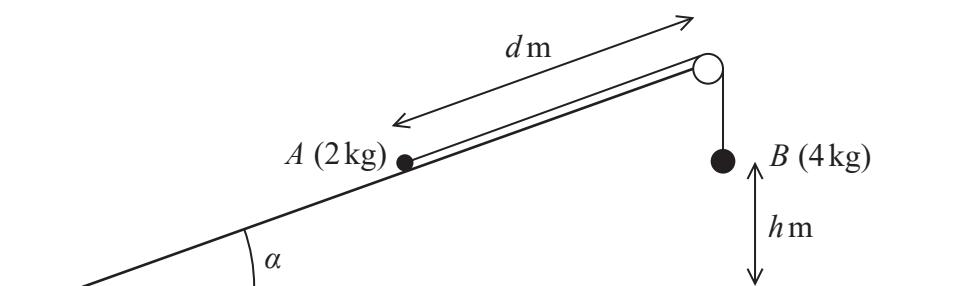


Figure 3

Two particles,  $A$  and  $B$ , have masses  $2\text{ kg}$  and  $4\text{ kg}$  respectively. The particles are connected by a light inextensible string. The string passes over a small smooth pulley which is fixed at the top of a rough plane. The plane is inclined to the horizontal ground at an angle  $\alpha$  where  $\tan \alpha = \frac{3}{4}$ . The particle  $A$  is held at rest on the plane at a distance  $d$  metres from the pulley. The particle  $B$  hangs freely at rest, vertically below the pulley, at a distance  $h$  metres above the ground, as shown in Figure 3. The part of the string between  $A$  and the pulley is parallel to a line of greatest slope of the plane. The coefficient of friction between  $A$  and the plane is  $\frac{1}{4}$ .

The system is released from rest with the string taut and  $B$  descends.

- (a) Find the tension in the string as  $B$  descends. (9)

On hitting the ground,  $B$  immediately comes to rest.

Given that  $A$  comes to rest before reaching the pulley,

- (b) find, in terms of  $h$ , the range of possible values of  $d$ . (7)

- (c) State one physical factor, other than air resistance, that could be taken into account to make the model described above more realistic. (1)

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### Question 8 continued

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Question 8 continued

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Question 8 continued

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Q8

(Total 17 marks)

TOTAL FOR PAPER: 75 MARKS

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