

Please check the examination details below before entering your candidate information

Candidate surname	Other names
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**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 <b>WME01/01</b>
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**Mathematics**  
**International Advanced Subsidiary/Advanced Level**  
**Mechanics M1**

**You must have:**  
Mathematical Formulae and Statistical Tables (Blue), calculator

Total Marks

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**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 ►





















Question 4 continued

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Q4

(Total 6 marks)

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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



6. Two girls, Agatha and Brionie, are roller skating inside a large empty building. The girls are modelled as particles.

At time  $t = 0$ , Agatha is at the point with position vector  $(11\mathbf{i} + 11\mathbf{j})\text{m}$  and Brionie is at the point with position vector  $(7\mathbf{i} + 16\mathbf{j})\text{m}$ . The position vectors are given relative to the door,  $O$ , and  $\mathbf{i}$  and  $\mathbf{j}$  are horizontal perpendicular unit vectors.

Agatha skates with constant velocity  $(3\mathbf{i} - \mathbf{j})\text{ms}^{-1}$

Brionie skates with constant velocity  $(4\mathbf{i} - 2\mathbf{j})\text{ms}^{-1}$

- (a) Find the position vector of Agatha at time  $t$  seconds. (2)

At time  $t = 6$  seconds, Agatha passes through the point  $P$ .

- (b) Show that Brionie also passes through  $P$  and find the value of  $t$  when this occurs. (4)

At time  $t$  seconds, Agatha is at the point  $A$  and Brionie is at the point  $B$ .

- (c) Show that  $\overrightarrow{AB} = [(t - 4)\mathbf{i} + (5 - t)\mathbf{j}]\text{m}$  (2)

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

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**Question 6 continued**

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Question 6 continued

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Q6

(Total 12 marks)



7. A helicopter is hovering at rest above horizontal ground at the point  $H$ . A parachutist steps out of the helicopter and immediately falls vertically and freely under gravity from rest for 2.5 s. His parachute then opens and causes him to immediately decelerate at a constant rate of  $3.9 \text{ m s}^{-2}$  for  $T$  seconds ( $T < 6$ ), until his speed is reduced to  $V \text{ m s}^{-1}$ . He then moves with this constant speed  $V \text{ m s}^{-1}$  until he hits the ground. While he is decelerating, he falls a distance of 73.75 m. The total time between the instant when he leaves  $H$  and the instant when he hits the ground is 20 s.

The parachutist is modelled as a particle.

- (a) Find the speed of the parachutist at the instant when his parachute opens. (1)
- (b) Sketch a speed-time graph for the motion of the parachutist from the instant when he leaves  $H$  to the instant when he hits the ground. (2)
- (c) Find the value of  $T$ . (5)
- (d) Find, to the nearest metre, the height of the point  $H$  above the ground. (4)

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Question 7 continued

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Q7

(Total 12 marks)



8.

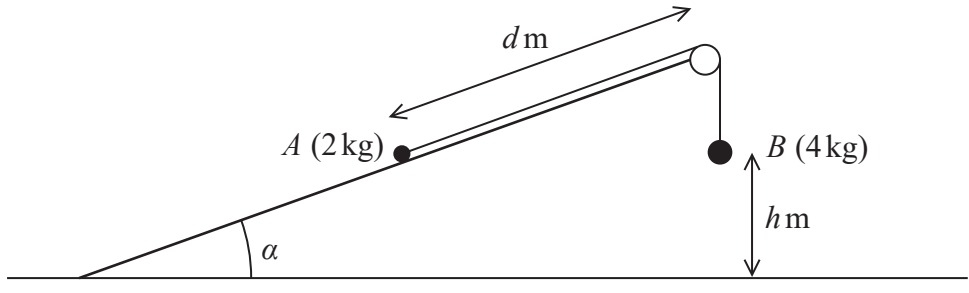


Figure 3

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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Q8

(Total 17 marks)

TOTAL FOR PAPER: 75 MARKS

END

