Please check the examination details	below before ente	ering your candidate inform	ation
Candidate surname		Other names	
Centre Number Candidate	Number		
Pearson Edexcel Inte	ernation	al Advanced	l Level
Time 1 hour 30 minutes	Paper reference	WME01	/01
Mathematics			
International Advanced	Subsidiar	v/Advanced Lev	vel
Mechanics M1		, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
Wiecilaliics Wi			
You must have: Mathematical Formulae and Statis	tical Tables (Ye	ellow), 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 $g = 9.8 \,\mathrm{m\,s^{-2}}$, 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 ▶







1.

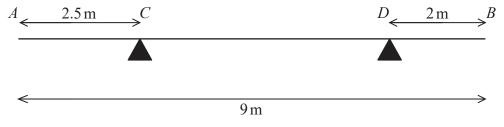


Figure 1

A non-uniform rod AB has length 9 m and mass $M \log$.

The rod rests in equilibrium in a horizontal position on two supports, one at C where AC = 2.5 m and the other at D where DB = 2 m, as shown in Figure 1.

The magnitude of the force acting on the rod at D is twice the magnitude of the force acting on the rod at C.

The centre of mass of the rod is d metres from A.

(6)

	L b
estion 1 continued	



Leave blank

Question 1 continued		

Question 1 continued	blank
	Q1
(Total 6 marks)	
(' ' ' ')	



- A particle P of mass 2m is moving on a rough horizontal plane when it collides directly with a particle Q of mass 4m which is at rest on the plane. The speed of P immediately before the collision is 3u. The speed of Q immediately after the collision is 2u.
 - (a) Find, in terms of u, the speed of P immediately after the collision.

(3)

(b) State clearly the direction of motion of *P* immediately after the collision.

(1)

Following the collision, Q comes to rest after travelling a distance $\frac{6u^2}{g}$ along the plane.

The coefficient of friction between Q and the plane is μ .

(c)	Find	the	value	of μ	ι.
-----	------	-----	-------	----------	----

5)

(e) That the value of μ.		(6

	Lo bi
nestion 2 continued	



Leave blank

Question 2 continued	

Question 2 continued	blank
	Q2
(Total 10 marks)	



3. A car is moving at a constant speed of 25 m s⁻¹ along a straight horizontal road. The car is modelled as a particle. At time t = 0, the car is at the point A and the driver sees a road sign 48 m ahead. Let t seconds be the time that elapses after the car passes A. In a first model, the car is assumed to decelerate uniformly at 6 m s⁻² from A until the car reaches the road sign. (a) Use this first model to find the speed of the car as it reaches the sign. **(2)** The road sign indicates that the speed limit immediately after the sign is 13 m s⁻¹. In a **second** model, the car is assumed to decelerate uniformly at 6 m s⁻² from A until it reaches a speed of 13 m s⁻¹. The car then maintains this speed until it reaches the road sign. (b) Use this second model to find the value of t at which the car reaches the sign. **(4)** In a **third** model, the car is assumed to move with constant speed 25 m s⁻¹ from A until time t = 0.2, the car then decelerates uniformly at 6 m s⁻² until it reaches a speed of 13 m s⁻¹. The car then maintains this speed until it reaches the road sign. (c) Use this third model to find the value of t at which the car reaches the sign. **(4)**



	Le
uestion 3 continued	bl



Leave blank

Question 3 continued		

Question 3 continued	Leave
Question 5 continued	
	Q3
(Total 10 marks)	
(Total To marks)	



4. The position vector, \mathbf{r} metres, of a particle P at time t seconds, relative to a fixed origin O, is given by

$$\mathbf{r} = (t-3)\mathbf{i} + (1-2t)\mathbf{j}$$

- (a) Find, to the nearest degree, the size of the angle between \mathbf{r} and the vector \mathbf{j} , when t = 2
- (b) Find the values of t for which the distance of P from O is 2.5 m.

(5)

	Leave blank
Question 4 continued	Olalik



Leave blank

Question 4 continued	

Question 4 continued	blank
	Q4
(Total 8 marks)	



5.

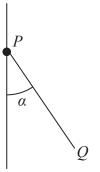


Figure 2

A small bead of mass $0.2 \,\mathrm{kg}$ is attached to the end P of a light rod PQ. The bead is threaded onto a fixed vertical rough wire.

The bead is held in equilibrium with the rod PQ inclined to the wire at an angle α , where $\tan \alpha = \frac{4}{3}$, as shown in Figure 2.

The thrust in the rod is *T* newtons.

The bead is modelled as a particle.

(a) Find the magnitude and direction of the friction force acting on the bead when T = 2.5

(3)

The coefficient of friction between the bead and the wire is μ .

Given that the greatest possible value of T is 6.125

(b) find the value of μ .

(7)

	Leave blank
Question 5 continued	



Leave blank

Question 5 continued		

Question 5 continued	Leave
	Q5
(Total 10 marks)	
(10th 10 marks)	



6.

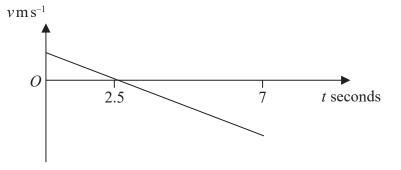


Figure 3

A small ball is thrown vertically upwards at time t = 0 from a point A which is above horizontal ground. The ball hits the ground 7s later.

The ball is modelled as a particle moving freely under gravity.

The velocity-time graph shown in Figure 3 represents the motion of the ball for $0 \le t \le 7$

(a) Find the speed with which the ball is thrown.

(2)

(b) Find the height of A above the ground.

(3)

Question 6 continued	blank
	Q6
(Total 5 marks)	



7.

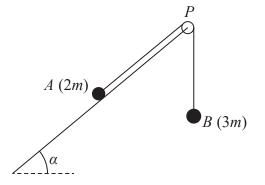


Figure 4

One end of a light inextensible string is attached to a particle A of mass 2m. The other end of the string is attached to a particle B of mass 3m. The string passes over a small, smooth, light pulley P which is fixed at the top of a rough inclined plane. The plane is inclined to

the horizontal at an angle α , where $\tan \alpha = \frac{3}{4}$

Particle A is held at rest on the plane with the string taut and B hanging freely below P, as shown in Figure 4. The section of the string AP is parallel to a line of greatest slope of the plane.

The coefficient of friction between A and the plane is $\frac{1}{2}$

Particle A is released and begins to move up the plane.

For the motion before A reaches the pulley,

- (a) (i) write down an equation of motion for A,
 - (ii) write down an equation of motion for B,

(4)

(b) find, in terms of g, the acceleration of A,

(5)

(c) find the magnitude of the force exerted on the pulley by the string.

(4)

(d) State how you have used the information that P is a smooth pulley.

(1)



	Lo b
uestion 7 continued	



Leave blank

Question 7 continued				

Question 7 continued	Leave
	Q7
(Total 14 marks)	



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

At 7 am a ship leaves a port and moves with constant velocity. The position vector of the port is $(-2\mathbf{i} + 9\mathbf{j})$ km.

At 7.36 am the ship is at the point with position vector $(4\mathbf{i} + 6\mathbf{j})$ km.

(a) Show that the velocity of the ship is $(10\mathbf{i} - 5\mathbf{j}) \, \text{km} \, h^{\text{--1}}$

(2)

(b) Find the position vector of the ship t hours after leaving port.

(2)

At 8.48 am a passenger on the ship notices that a lighthouse is due east of the ship.

At 9 am the same passenger notices that the lighthouse is now north east of the ship.

(c) Find the position vector of the lighthouse.

(4)

(d) Find the position vector of the ship when it is due south of the lighthouse.

(4)

	Leave blank
Question 8 continued	Olalik



Leave blank

Question 8 continued	

	Leave
	blank
Question 8 continued	

END