

Please write clearly in block capitals.

Centre number

Candidate number

Surname \_\_\_\_\_

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I declare this is my own work.

# INTERNATIONAL AS MATHEMATICS

(9660/MA02) Unit PSM1 Pure Mathematics, Statistics and Mechanics

Wednesday 8 January 2025 07:00 GMT Time allowed: 1 hour 30 minutes

### Materials

- For this paper you must have the OxfordAQA Booklet of Formulae and Statistical Tables (enclosed).
- You may use a graphical calculator.

### Instructions

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

### Information

- The marks for questions are shown in brackets.
- There are three sections to this paper.
- The maximum mark for this paper is 80. There are 40 marks for **Section A**, 20 marks for **Section B** and 20 marks for **Section C**.

### Advice

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- Show all necessary working; otherwise marks may be lost.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
<b>TOTAL</b>	



**Section A****Pure Mathematics**

Answer **all** questions in the spaces provided.

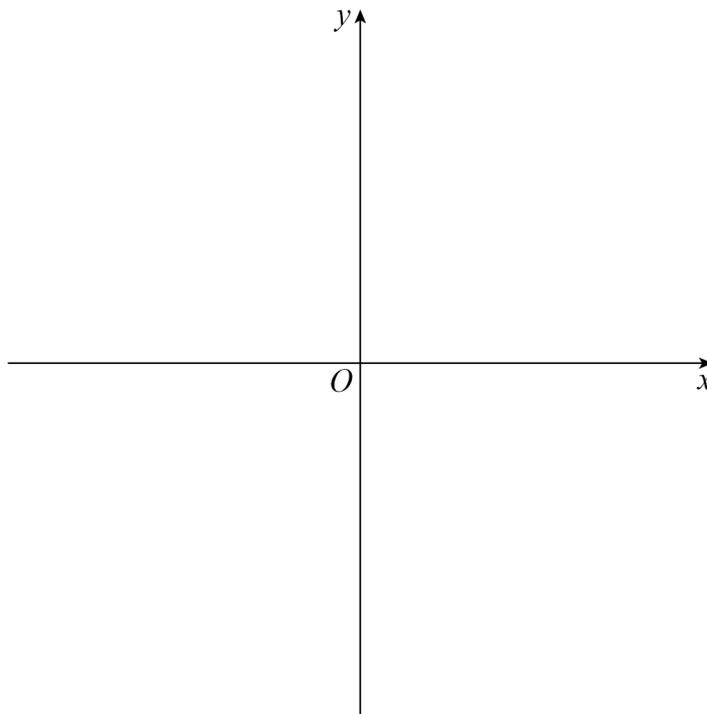
- 1** A curve has equation

$$y = 2^{(x-3)} - 4$$

- 1 (a)** Sketch the graph of the curve on the axes below.

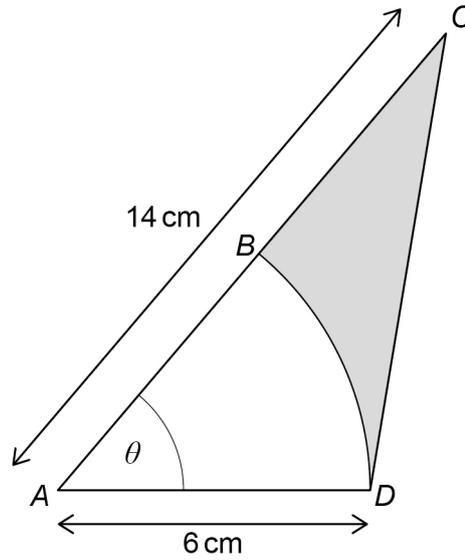
Show on your graph the values of any intercepts with the axes.

**[3 marks]**





- 2** The diagram below shows the triangle  $ACD$  and a sector  $ABD$  of a circle with centre  $A$ .  
The point  $B$  lies on the line segment  $AC$ .



The length  $AD = 6\text{ cm}$

The length  $AC = 14\text{ cm}$

The angle  $BAD = \theta$  radians

- 2 (a)** The sector  $ABD$  has area  $16.2\text{ cm}^2$

Show that  $\theta = 0.9$

**[2 marks]**

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**2 (b)** The shaded region is bounded by the line segments  $BC$  and  $CD$  and the arc  $BD$

**2 (b) (i)** Find the area of the shaded region.

Give your answer in  $\text{cm}^2$  to three significant figures.

**[3 marks]**

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Answer \_\_\_\_\_

**2 (b) (ii)** Find the perimeter of the shaded region.

Give your answer in  $\text{cm}$  to three significant figures.

**[4 marks]**

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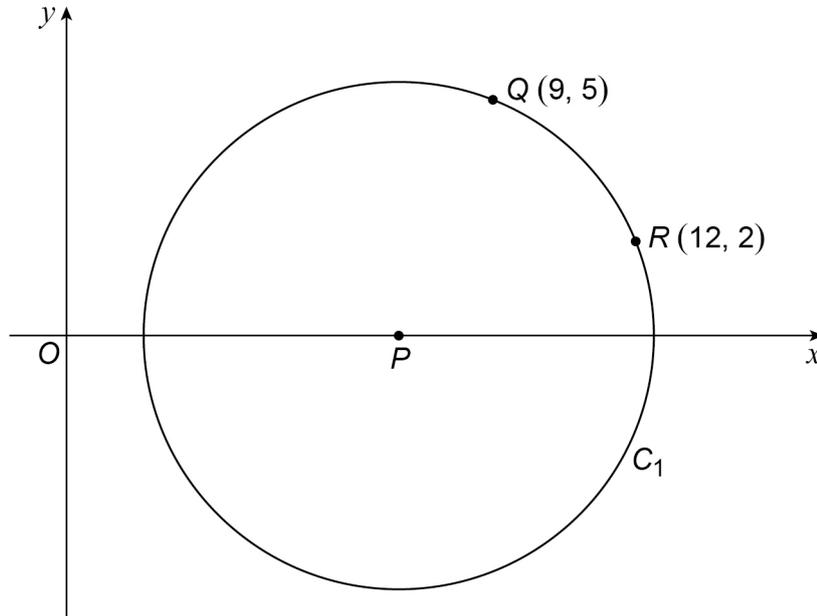
Answer \_\_\_\_\_

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Turn over ►



- 3** The diagram below shows a circle  $C_1$  with centre at the point  $P$
- The point  $P$  lies on the  $x$ -axis.
- The points  $Q(9, 5)$  and  $R(12, 2)$  lie on  $C_1$



- 3 (a)** Use the property of the perpendicular bisector of a chord to show that the  $x$ -coordinate of  $P$  is 7

**[4 marks]**

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**3 (b)** A different circle  $C_2$  touches  $C_1$  at the point  $R$

The circles  $C_1$  and  $C_2$  have the same radius.

**3 (b) (i)** Find the equation of  $C_2$

Give your answer in the form  $(x-a)^2 + (y-b)^2 = k$  where  $a$ ,  $b$  and  $k$  are integers.

**[4 marks]**

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Answer \_\_\_\_\_

**3 (b) (ii)** Describe the single transformation which maps  $C_1$  onto  $C_2$

**[2 marks]**

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4 (a) The function  $f$  is defined by

$$f(x) = 5 - 2\cos(x - 47^\circ)$$

4 (a) (i) State the greatest possible value of  $f(x)$

[1 mark]

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Answer \_\_\_\_\_

4 (a) (ii) Find the value of  $x$  in the interval  $0^\circ \leq x \leq 360^\circ$  at which the greatest possible value of  $f(x)$  occurs.

[1 mark]

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Answer \_\_\_\_\_









**Section B****Statistics**

Answer **all** questions in the spaces provided.

- 6** A shop sells vegetables.  
When visiting the shop, 9% of customers buy carrots.  
A week is chosen at random.  
A total of 40 customers visit the shop on Monday.  
Whether a customer buys carrots is independent of whether another customer buys carrots.

- 6 (a)** Find the probability that exactly 6 customers buy carrots on Monday.  
Give your answer to four decimal places.

**[1 mark]**


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Answer \_\_\_\_\_

- 6 (b)** Find the probability that more than 4 customers buy carrots on Monday.  
Give your answer to four decimal places.

**[2 marks]**


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Answer \_\_\_\_\_



- 6 (c)** The variance of the number of customers who buy carrots on Tuesday is 2.3751
- The variance of the number of customers who buy carrots on Wednesday is 2.1294
- The number of customers who buy carrots on any day is independent of the number of customers who buy carrots on any other day.

- 6 (c) (i)** Find the variance of the total number of customers who buy carrots over the whole three-day period from Monday to Wednesday.

[2 marks]

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Answer \_\_\_\_\_

- 6 (c) (ii)** Find the total number of customers who visit the shop over the whole three-day period from Monday to Wednesday.

[2 marks]

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Answer \_\_\_\_\_

7

**Turn over for the next question****Turn over ►**



7 (b) The probability that Jing buys lunch at work on a randomly chosen weekday is  $\frac{5}{7}$

The probability that Jing goes for a run before going to work and buys lunch at work is  $\frac{9}{50}$

Find the probability that Jing goes for a run before going to work or buys lunch at work.

**[2 marks]**

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Answer \_\_\_\_\_

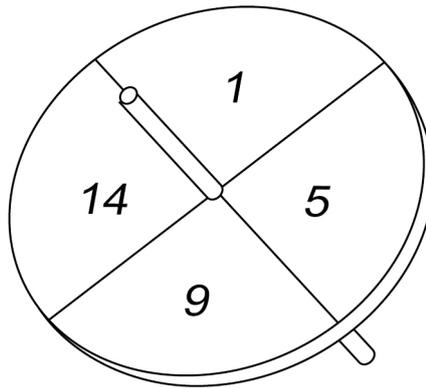
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**Turn over for the next question**

**Turn over ►**



- 8 A biased spinning top has four sections with values 1, 5, 9 and 14



The random variable  $A$  represents the value of the section that the spinning top lands on when it is spun.

The probability of this spinning top landing on a particular section is directly proportional to the value on that section.

- 8 (a) Show that the mean of  $A$  is  $\frac{303}{29}$

[4 marks]

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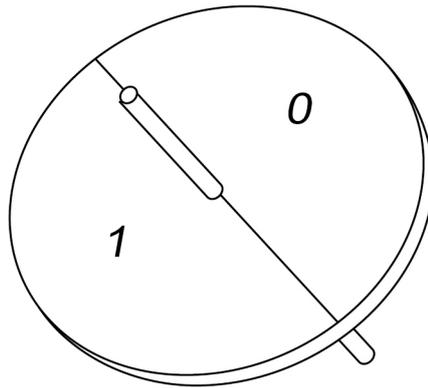
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- 8 (b) A second biased spinning top has two sections with values 0 and 1



The random variable  $B$  represents the value of the section that this second spinning top lands on when it is spun.

It is given that  $P(B=0) = \frac{11}{16}$

The random variable  $C$  represents the value of the section that a third spinning top lands on when it is spun.

The random variables  $A$ ,  $B$  and  $C$  are independent.

The score of a game is obtained by adding up the values on the sections landed on when all three spinning tops are spun.

The mean score is 11

Find the mean of  $C$

[3 marks]

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Answer \_\_\_\_\_

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**Section C****Mechanics**

Answer **all** questions in the spaces provided.

**9** The acceleration due to gravity,  $g$ , should be taken as  $9.8 \text{ m s}^{-2}$

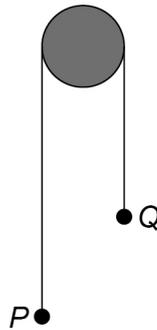
Two particles  $P$  and  $Q$  are connected by a light inextensible string that passes over a smooth light pulley.

Particle  $P$  is held below the pulley, and both particles are at rest.

The mass of  $P$  is  $0.4 \text{ kg}$  and the mass of  $Q$  is  $0.7 \text{ kg}$

Particle  $P$  is released.

Immediately after release,  $Q$  accelerates vertically downwards at  $a \text{ m s}^{-2}$



Find the value of  $a$

**[3 marks]**

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$a =$  \_\_\_\_\_

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Turn over ►



**10** A toy car is initially at rest on a horizontal surface.

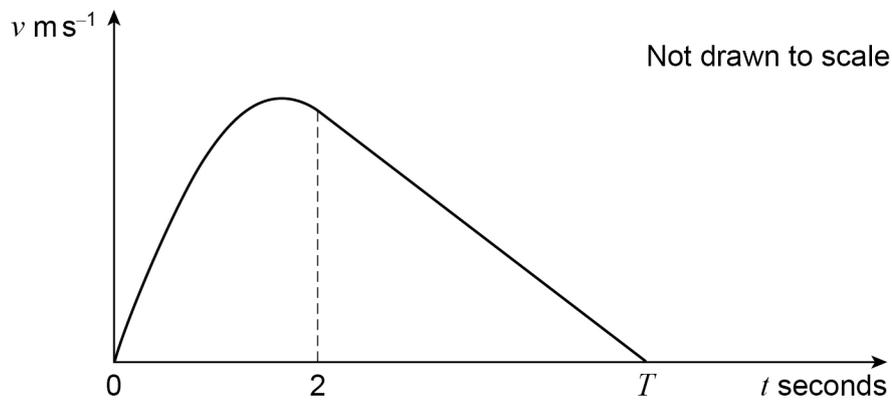
The velocity  $v \text{ m s}^{-1}$  of the toy car at time  $t$  seconds is given by

$$v = \begin{cases} -0.5t^2 + 1.9t & \text{for } 0 \leq t \leq 2 \\ 1.8 - k(t-2) & \text{for } 2 < t \leq T \\ 0 & \text{for } t > T \end{cases}$$

where  $k$  is a positive constant.

The car comes to rest when  $t = T$

The velocity-time graph for the car is shown below.



**10 (a)** Show that the maximum speed of the car is  $1.805 \text{ m s}^{-1}$

**[4 marks]**

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- 11** Two particles  $A$  and  $B$  are moving directly towards each other on a smooth horizontal surface.
- Particle  $A$  has mass  $2 \text{ kg}$  and moves with speed  $12 \text{ m s}^{-1}$
- Particle  $B$  has mass  $m \text{ kg}$  and moves with speed  $2q \text{ m s}^{-1}$  where  $m$  and  $q$  are positive constants.
- The particles collide.
- After the collision, particle  $A$  continues to travel in its initial direction and the speed of particle  $B$  is  $4 \text{ m s}^{-1}$

- 11 (a)** The impulse exerted on particle  $A$  during the collision has magnitude  $I \text{ N s}$

Find the range of possible values of  $I$

**[2 marks]**

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