OXFORD

INTERNATIONAL
AQA EXAMINATIONS

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

INTERNATIONAL AS

MATHEMATICS

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

Time allowed: 1 hour 30 minutes

Materials

- For this paper you must have the Oxford International AQA Booklet of Formulae and Statistical Tables (enclosed).
- You may use a graphic 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	
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10	
11	
12	
TOTAL	

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Section A

Pure Mathematics

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

1 A curve has the equation

$$y = A \times 3^{kx}$$

where A and k are constants.

The curve passes through the points $(0, 4)$ and $(8, 20)$

1 (a) (i) Write down the value of A

[1 mark]

$A =$ _____

1 (a) (ii) Find the value of k, giving your answer in the form $b \log_3 c$ where b and c are constants.

[2 marks]

$k =$ _____

Do not write outside the box

1 (b) Solve $4^{2x} = 11$ giving your answer to three significant figures.

[2 marks]

$x =$ _____

5

Turn over for the next question

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2 The diagram shows a sector *OAB* of a circle of radius r cm

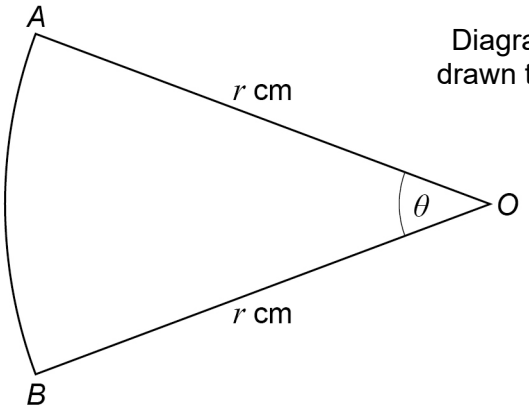


Diagram not drawn to scale

The **acute** angle *AOB* is θ radians

The area of the sector is 3 cm^2

The perimeter of the sector is 8 cm

Find the value of r and the value of θ

[5 marks]

$r =$ _____ $\theta =$ _____

5

Do not write outside the box

3 (a) Given that

$$\log_a(2x) = 3\log_a 4 + \log_a 5$$

show that $x = 160$

[3 marks]

3 (b) Given that

$$\log_a y = 9 + \log_a 10$$

express y in terms of a, giving your answer in a form not involving logarithms.

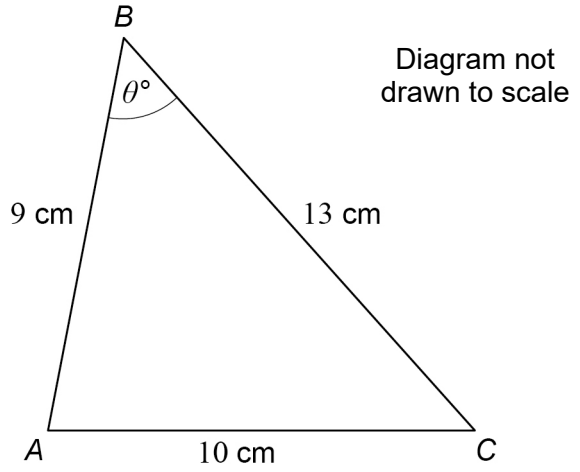
[3 marks]

$y =$ _____

6

Do not write outside the box

4 (a) The diagram shows a triangle *ABC*



The lengths $AB = 9$ cm, $AC = 10$ cm and $BC = 13$ cm

Angle $ABC = \theta^\circ$

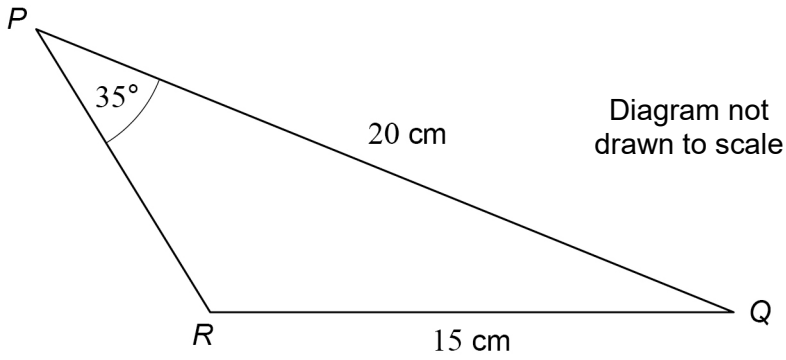
Find the value of θ giving your answer to one decimal place.

[3 marks]

$\theta =$ _____

Do not write outside the box

4 (b) The diagram shows a triangle *PQR*



The lengths $PQ = 20$ cm and $QR = 15$ cm

Angle $QPR = 35°$

Angle *PQR* is **acute**.

Find the area of the triangle *PQR*, giving your answer to three significant figures.

[5 marks]

Answer _____ cm^2

8

Turn over ►

Do not write outside the box

5 (a) Given that

$$\left(\cos x - \tan x\right)^2 + \left(1 + \sin x\right)^2 = 5$$

show that

$$\tan^2 x = 3$$

[3 marks]

5 (b) (i) Solve

$$\left(\cos x - \tan x\right)^2 + \left(1 + \sin x\right)^2 = 5$$

in the interval $0 \leq x \leq \pi$

[2 marks]

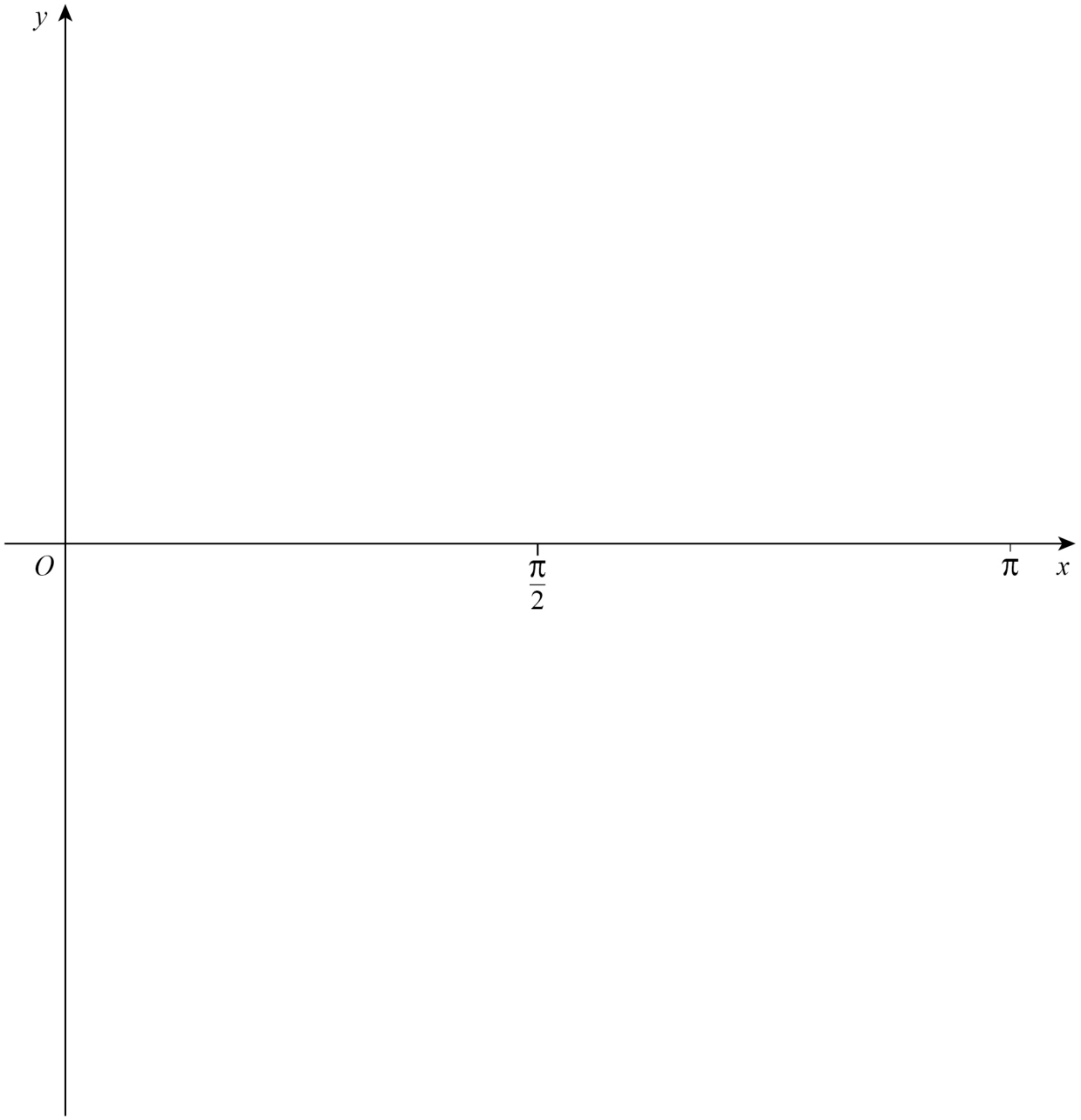
Answer _____

Do not write outside the box

5 (b) (ii) On the axes below, sketch the graph of $y = \tan x$ for $0 \leq x \leq \pi$

Show on your sketch the solutions found in **part (b)(i)**.

[2 marks]



7

Do not write outside the box

6 A circle C_1 has the equation

$$(x-3)^2+(y-1)^2=52$$

6 (a) State the radius of C_1 and the coordinates of its centre.

[2 marks]

Radius _____ Centre _____

6 (b) The point $P(7, 7)$ lies on C_1

The line L is the normal to C_1 at P

Find the equation of L

[2 marks]

Answer _____

Do not write outside the box

6 (c) A circle C_2 has radius $8\sqrt{13}$

C_1 touches C_2

L is the tangent to C_2 at the point Q

Find the possible distances PQ, giving each answer in an exact form.

[5 marks]

Answer _____

9

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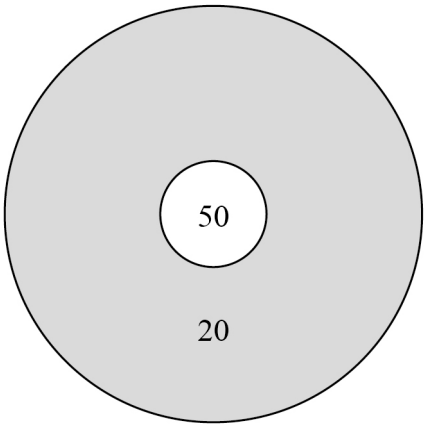
Section B

Statistics

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

7 Toyin is throwing darts at the target below.



The probability of event A, that Toyin scores 50 with her first throw, is 0.22

The probability of event B, that Toyin scores 50 with her second throw, is 0.13

The probability of event C, that Toyin scores 20 with her first throw, is 0.76

The events A and B are independent.

The events A and C are mutually exclusive.

7 (a) Find P(A $\cap$ B)

[2 marks]

Answer _____

Do not write outside the box

7 (b) State $P(A \cap C)$

[1 mark]

Answer _____

7 (c) Find the probability that Toyin scores 50 with her second throw given that she scores 50 with her first throw.

[2 marks]

Answer _____

5

Turn over for the next question

Do not write outside the box

8 An unbiased coin has two faces, 'heads' and 'tails'.

The coin is tossed into the air and lands on the floor.

The random variable H is defined as

$$H = \begin{cases} 1 & \text{if the coin lands with 'heads' facing upwards} \\ 0 & \text{if the coin lands with 'tails' facing upwards} \end{cases}$$

8 (a) State the distribution of H giving any parameters.

[2 marks]

8 (b) (i) Find $\mathrm{E}(H)$

[1 mark]

Answer _____

8 (b) (ii) Find $\mathrm{Var}(H)$

[1 mark]

Answer _____

Do not write outside the box

8 (c) The random variable K is defined as

$$K = \sum_{i=1}^{8} H_i$$

where $H_i = H$ for all values of i and H_i is independent of H_j for $i \neq j$

8 (c) (i) Find $\mathrm{Var}(K)$

[1 mark]

Answer _____

8 (c) (ii) Find $\mathrm{P}(K \geq 7)$ giving your answer to three decimal places.

[3 marks]

Answer _____

8

Turn over ►

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9 The discrete random variable X has the probability distribution given in the following table, where a and b are constants.

x	2	3	7	9
$P(X = x)$	a	0.2	0.34	b

The mean of X is 5.16

9 (a) Find the value of a and the value of b

[4 marks]

$a =$ _____ $b =$ _____

Do not write outside the box

9 (b) Find the standard deviation of X giving your answer to four significant figures.

[3 marks]

Answer _____

7

Turn over for Section C

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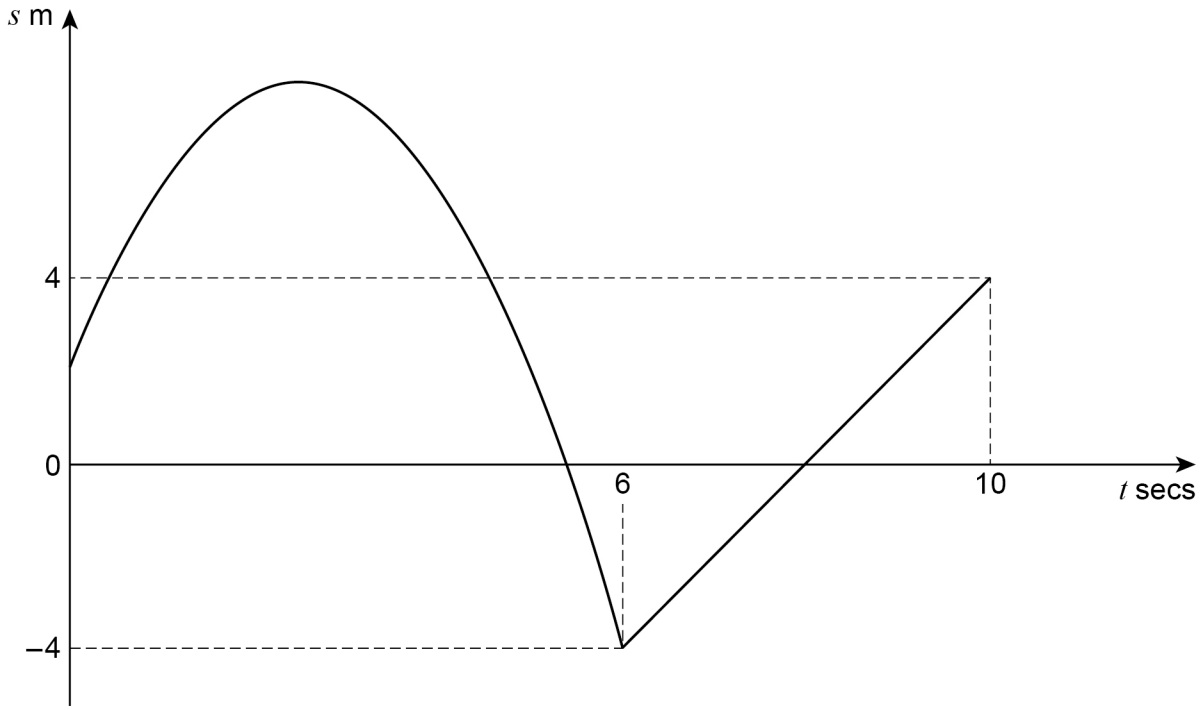
Section C

Mechanics

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

10 A bead moves in a straight line on a wire for 10 seconds.

The displacement, s metres, of the bead from a fixed point on the wire at time t seconds is shown in the displacement–time graph below.



For the first 6 seconds the displacement of the bead is given by

$$s = 2 + 5t - t^2$$

The displacement of the bead in the following 4 seconds is modelled by a linear equation in t

When $t = 6$, $s = -4$

When $t = 10$, $s = 4$

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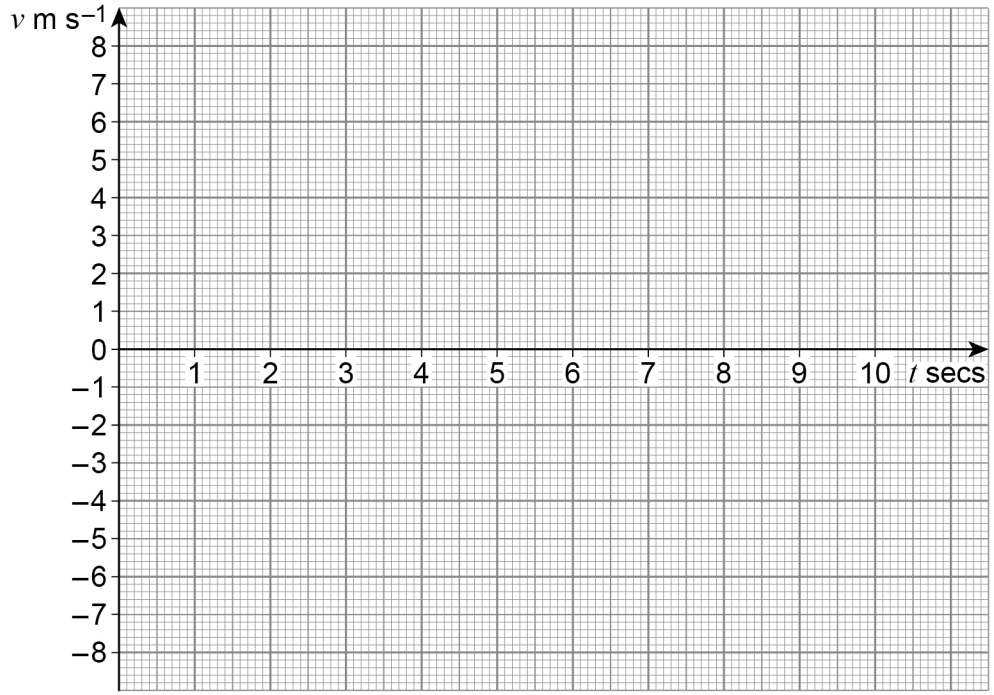
10 (a) On the axes below draw a velocity–time graph for the motion of the bead during the 10-second period.

[5 marks]



10 (b) Find the total distance travelled by the bead in the 10-second period.

[2 marks]

Answer _____ metres

7

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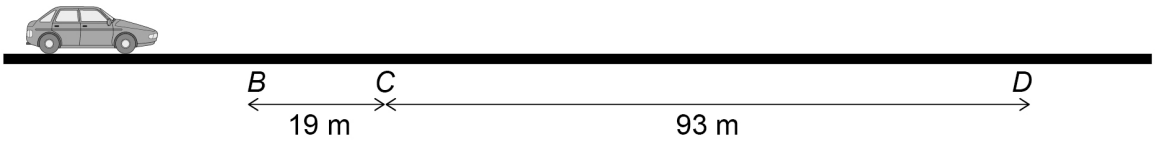
11 A car is moving along a straight horizontal road with constant acceleration a m s^{-2}

Diagram not drawn to scale



The car passes a point *B* with speed u m s^{-1}

2 seconds after it passes *B* it passes a point *C*. The distance $BC = 19$ metres.

6 seconds after it passes *C* it passes a point *D*. The distance $CD = 93$ metres.

11 (a) Find the value of a and the value of u

[5 marks]

$a =$ _____ $u =$ _____

Do not write outside the box

11 (b) The mass of the car is 1400 kg

Find the momentum of the car at *D*

[2 marks]

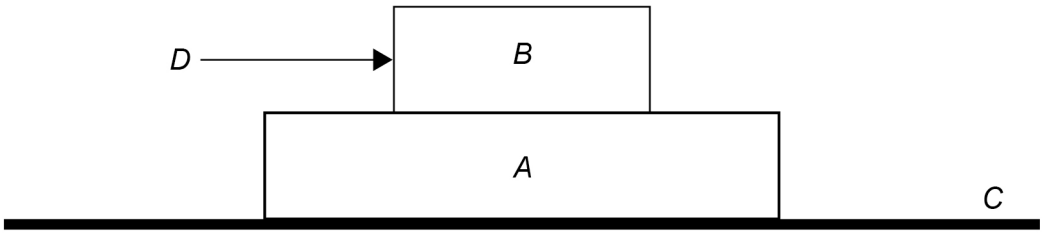
Answer _____ kg m s^{-1}

7

Turn over for the next question

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

The diagram below shows two cuboid boxes *A* and *B*
A is at rest on a rough horizontal surface *C*
B is at rest on top of *A*
The surfaces of *A* and *B* are rough.



The mass of *A* is 5 kg and the mass of *B* is 3.5 kg
The coefficient of friction between *A* and *C* is 0.2
The coefficient of friction between *B* and *A* is 0.6

A horizontal force *D* is applied to *B* as shown in the diagram.

12 (a) Show that if the force *D* is gradually increased from 0 newtons, then box *A* will begin to slide.

[4 marks]

Do not write outside the box

12 (b) When D is increased to 19 newtons, A and B accelerate at a m s^{-2}

Find the value of a, giving your answer to three significant figures.

[2 marks]

$a =$ _____

6

END OF QUESTIONS

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