OXFORD

INTERNATIONAL AQA EXAMINATIONS

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INTERNATIONAL AS
MATHEMATICS

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

Thursday 23 May 2019 07:00 GMT 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 graphics 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.
- The maximum mark for this paper is 80.

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	
TOTAL	

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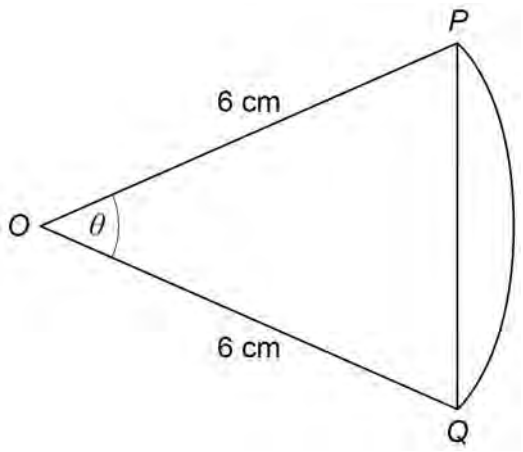
Section A

Pure Mathematics

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

1 The diagram shows a sector of a circle with radius 6 cm

PQ is a chord of the circle and the acute angle $POQ = \theta$ radians.



1 (a) The area of the triangle *OPQ* is 14 cm^2

Show that $\theta = 0.891$ correct to three significant figures.

[3 marks]

Do not write outside the box

1 (b) Find the length of the arc PQ, giving your answer to three significant figures.

[2 marks]

Answer _____ cm

5

Turn over for the next question

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2 The diagram below shows a circle and a tangent to the circle at the point $P(6, 12)$

The centre of the circle has coordinates $(a, 5a)$

The equation of the tangent is $y = 24 - 2x$

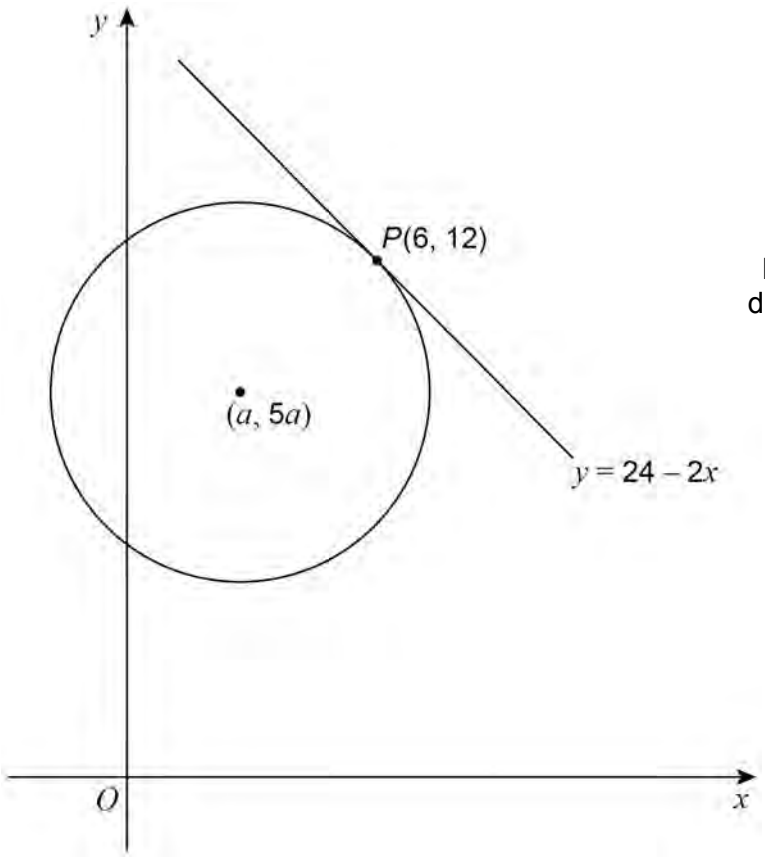


Diagram not drawn to scale

2 (a) Show that $a = 2$

[3 marks]

Do not write outside the box

2 (b) (i) Find the radius of the circle, giving your answer in the form $\sqrt{n}$, where n is an integer.

[2 marks]

Radius = _____

2 (b) (ii) Hence express the equation of the circle in the form

$$(x - b)^2 + (y - c)^2 = k$$

where b, c and k are positive integers.

[2 marks]

Answer _____

2 (c) Q is a different point on the circle.
The tangent to the circle at Q is parallel to the tangent to the circle at P.
State the coordinates of Q.

[2 marks]

Answer _____

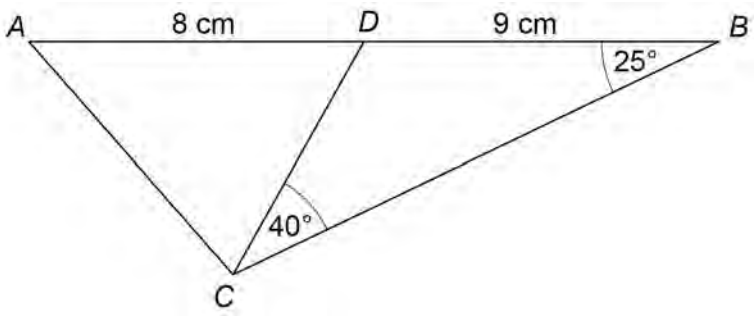
9

Do not write outside the box

3 The diagram shows the triangle *ABC* and the line segment *CD*.

The point *D* lies on *AB* such that *AD* = 8 cm and *BD* = 9 cm

Angle *BCD* = 40° and angle *CBD* = 25°



3 (a) Show that the length of *CD* is 5.92 cm correct to three significant figures.

[2 marks]

Do not write outside the box

3 (b) Find the length of AC, giving your answer to three significant figures.

[3 marks]

Answer _____ cm

3 (c) Find the shortest distance between the point A and the line CD, giving your answer to three significant figures.

[3 marks]

Answer _____ cm

8

Do not write outside the box

4 (a) Show that the equation

$$10\cos^2 x = 7\sin x - 2$$

can be written as

$$10\sin^2 x + 7\sin x - 12 = 0$$

[2 marks]

4 (b) A student, Megan, solves the equation

$$10\cos^2 x = 7\sin x - 2$$

She claims that the only real solutions of the equation satisfy

$$\sin x = \frac{4}{5}$$

Determine whether or not Megan is correct.

[4 marks]

Do not write outside the box

4 (c) Solve the equation

$$10\cos^2(\theta + 40°) = 7\sin(\theta + 40°) - 2$$

in the interval $0° \leq \theta \leq 360°$

Give your answers to the nearest degree.

[2 marks]

Answer _____

8

Turn over for the next question

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5 (a) Given that

$$\log_{10}\left(10^{a}\right) + \log_{4}\left(4^{b}\right) = 3$$

and

$$\log_{5}\left(\frac{125^{a}}{5^{b}}\right) = 7$$

find the value of a and the value of b.

[4 marks]

$a =$ _____ $b =$ _____

Do not write outside the box

5 (b) Given that x satisfies the equation

$$2\log_3(x + 7) - \log_3(5x - 1) = 2$$

find the possible values of x.

[6 marks]

$x =$ _____

10

Turn over for the next question

Do not write outside the box

Section B

Statistics

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

6 A housebuilder sells three types of houses which have two, three or four bedrooms.

Each house is bought by a single person, a family, or a company.

6 (a) The table shows some information about the type of house sold and the type of buyer.

Complete the table.

[1 mark]

		Type of house			
		2 bedroom	3 bedroom	4 bedroom	**Total**
Type of buyer	Single person	12	18	3	**33**
	Family	13		7	
	Company	5	2	0	**7**
	Total		**30**	**10**	

6 (b) A house is chosen at random.

6 (b) (i) Find the probability that the house is bought by a family and it contains four bedrooms.

[2 marks]

Answer _____

Do not write outside the box

6 (b) (ii) Find the probability that the house is bought by a company or it contains three bedrooms.

[2 marks]

Answer _____

6 (b) (iii) Find the probability that the house is bought by a single person given that it contains two bedrooms.

[2 marks]

Answer _____

7

Turn over for the next question

Do not write outside the box

7 The discrete random variable X has the probability distribution function

$$\mathrm{P}(X = x) = \begin{cases} a & x = 0 \\ b & x = 1 \\ 0.125 & x = 2,\ 3 \\ 0 & \text{otherwise} \end{cases}$$

and $\mathrm{E}(X^2 + 4) = 6.225$

7 (a) Find the value of a and the value of b.

[4 marks]

$a =$ _____ $b =$ _____

Do not write outside the box

7 (b) Let Y be the random variable such that $Y = X^2 + 4$

Find E($6Y$ – 9).

[2 marks]

Answer _____

6

Turn over for the next question

Do not write outside the box

8 David has an unbiased dice with six faces which are numbered '1' to '6'.

8 (a) He rolls the dice ten times.

Find the probability that he rolls a '6' exactly four times.

[2 marks]

Answer _____

Do not write outside the box

8 (b) Find the lowest number of rolls of the dice for the probability of rolling at least one '6' to be more than 95%.

[5 marks]

Answer _____

7

Turn over for the next question

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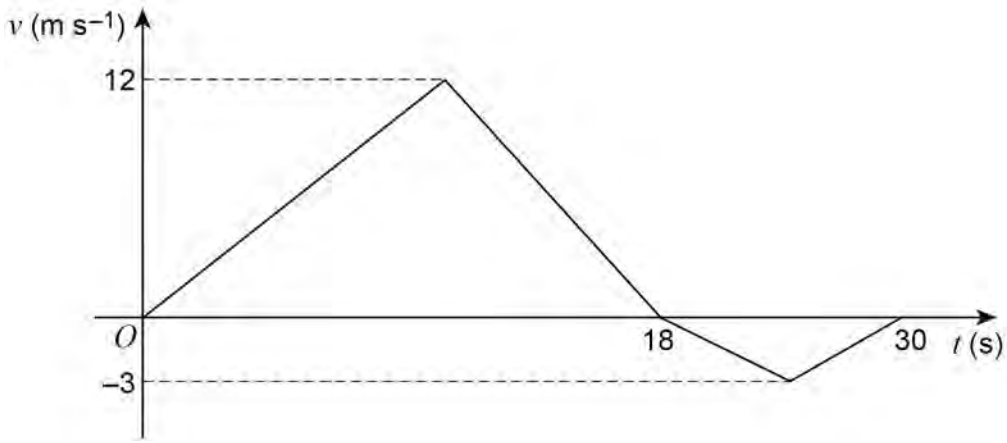
Section C

Mechanics

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

9 The diagram shows the velocity−time graph for a car that moves along a straight horizontal road during a 30-second period.



Find the average speed of the car during the 30-second period.

[5 marks]

Answer _____ m s^{-1}

5

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10 Two particles, *A* and *B*, are moving directly towards each other on a straight line and collide.

The mass of *A* is 6 kg and the mass of *B* is 4.5 kg

Before the collision, the speed of *A* is 12 m s^{-1} and the speed of *B* is 8 m s^{-1}

After the collision, *A* continues in the same direction with speed 3 m s^{-1} and *B* has speed v m s^{-1}

10 (a) Using the principle of conservation of momentum find the value of v.

[3 marks]

$v =$ _____

10 (b) Find the magnitude of the impulse exerted on *B* by *A*.

[2 marks]

Answer _____ N s

5

Turn over ►

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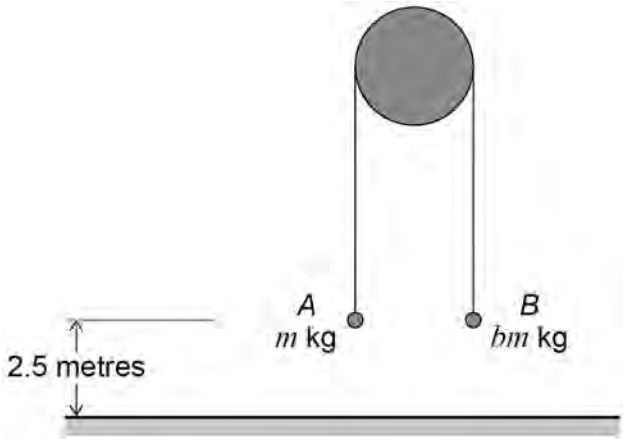
11 **The acceleration due to gravity, g, should be taken as 9.8 m s^{-2}**

Two particles, *A* and *B*, are connected by a light inextensible string that passes over a smooth light pulley.

Particle *A* has mass m kg and particle *B* has mass bm kg, where $b > 1$



The particles are held at rest at a height of 2.5 metres above horizontal ground with the string taut.

When the particles are released, they begin to move vertically and the magnitude of the acceleration of each particle is 1.4 m s^{-2}

11 (a) By forming an equation of motion for each particle find the value of b.

[6 marks]

Do not write outside the box

$b =$ _____

11 (b) At the instant particle *B* hits the surface, the string breaks and particle *A* continues to move vertically. Particle *A* does not collide with the pulley.

In the resulting motion, find the time it takes particle *A* to reach its maximum height.

Give your answer to two significant figures.

[4 marks]

Answer _____ seconds

10

END OF QUESTIONS

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