OXFORD

INTERNATIONAL
AQA EXAMINATIONS

Please write clearly in block capitals.

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

Surname _____

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INTERNATIONAL AS
MATHEMATICS

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

Specimen 2018 Morning Time allowed: 1 hour 30 minutes

Materials

- For this paper you must have the booklet of formulae and statistical tables.
- 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 each question in the space provided for that question. If you require extra space, use a supplementary answer book; do **not** use the space provided for a different question.
- Do not write outside the box or around each page.
- Show all necessary working; otherwise marks for method may be lost.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- Unless otherwise stated, use $g = 9.8$ ms^{-2}

Information

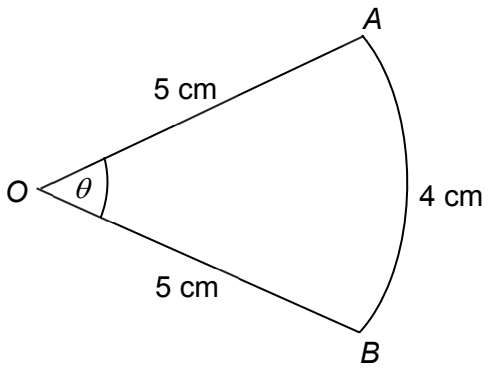
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.

Advice

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- You do not necessarily need to use all the space provided.

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

1 The diagram shows a sector OAB of a circle with centre O and radius 5 cm.



The angle between the radii OA and OB is θ radians.

The length of the arc AB is 4 cm.

1 (a) Find the value of θ.

[2 marks]

Answer _____

1 (b) Find the area of the sector OAB.

[2 marks]

Answer _____ cm^2

2 A circle has centre C (3, −8) and radius 10.

2 (a) Express the equation of the circle in the form

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

[2 marks]

2 (b) Find the x-coordinates of the points where the circle crosses the x-axis.

[3 marks]

Answer _____

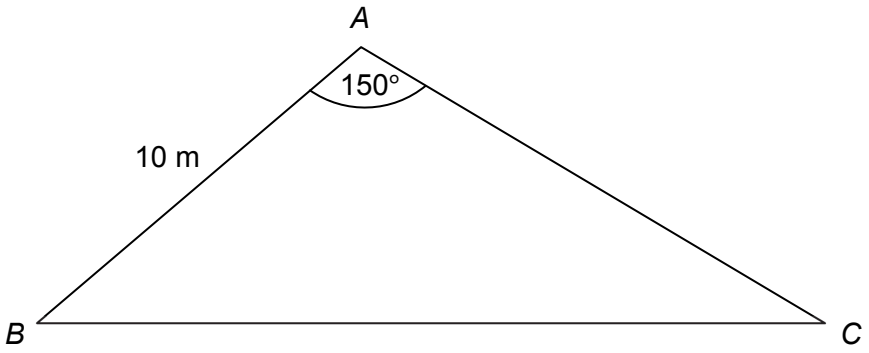
2 (c) The tangent to the circle at the point A has gradient $\frac{5}{2}$

Find an equation of the line CA, giving your answer in the form $rx + sy + t = 0$, where r, s and t are integers.

[3 marks]

Answer _____

3 The triangle *ABC*, shown in the diagram, is such that *AB* is 10 metres and angle *BAC* is 150°.



The area of triangle *ABC* is 40 m^2

3 (a) Show that the length of *AC* is 16 metres.

[2 marks]

3 (b) Calculate the length of *BC,* giving your answer in metres, to two decimal places.

[3 marks]

Answer _____ m

3 (c) Calculate the smallest angle of triangle *ABC,* giving your answer to the nearest 0.1°.

[3 marks]

Answer _____ degrees

4 (a) Solve the equation $\tan x = -3$ in the interval $0° \leq x \leq 360°$, giving your answers to the nearest degree.

[3 marks]

Answer _____

4 (b) (i) Given that

$$7\sin^2\theta + \sin\theta\cos\theta = 6$$

show that

$$\tan^2\theta + \tan\theta - 6 = 0$$

[3 marks]

4 (b) (ii) Hence solve the equation $7\sin^2\theta + \sin\theta\cos\theta = 6$ in the interval $0° \leq x \leq 360°$, giving your answers to the nearest degree.

[4 marks]

Answer _____

5 (a) Sketch the graph of $y = \frac{1}{2^x}$, indicating the value of the intercept on the y-axis

[2 marks]

5 (b) Use logarithms to solve the equation $\frac{1}{2^x} = \frac{5}{4}$, giving your answer to three significant figures.

[3 marks]

Answer _____

5 (c) Given that

$$\log_a b^2 + 3\log_a y = 3 + 2\log_a\left(\frac{y}{a}\right)$$

express y in terms of a and b.

Give your answer in a form **not** involving logarithms.

[5 marks]

Answer _____

6 An analysis of the number of vehicles owned by each household within a city is shown in the table.

Number of vehicles	0	1	2	≥3
Percentage of households	18	47	25	10

A random sample of 30 households within the city is selected.

Use a binomial distribution with $n = 30$, together with relevant information from the table in each case, to find the probability that the sample contains:

6 (a) exactly 3 households with **no** vehicles;

[3 marks]

Answer _____

6 (b) more than 10 households with at least **two** vehicles.

[3 marks]

Answer _____

7 A blue biased tetrahedral die is rolled.

The number, Y, on the face on which it lands has the probability distribution given by

$$\mathrm{P}(Y = y) = \begin{cases} \frac{y}{20} & y = 1, 2 \text{ and } 3 \\ \frac{7}{10} & y = 4 \end{cases}$$

The random variable T is the value obtained when the number on the face on which it lands is **multiplied** by 3

Calculate $E(T)$ and $\mathrm{Var}(T)$.

[6 marks]

$E(T) =$ _____

$\mathrm{Var}(T) =$ _____

8 Dina is a member of a tenpin bowling club which meets at a bowling alley on Wednesday and Thursday evenings.

The probability that she bowls on a Wednesday evening is 0.90. Independently, the probability that she bowls on a Thursday evening is 0.95.

8 (a) Calculate the probability that, during a particular week, Dina bowls on:

8 (a) (i) two evenings;

[1 mark]

Answer _____

8 (a) (ii) exactly one evening.

[2 marks]

Answer _____

8 (b) Imran, a friend of Dina, is a member of the same club.

The probability that he bowls on a Wednesday evening, given that Dina bowls on that evening, is 0.80. The probability that he bowls on a Wednesday evening, given that Dina does not bowl on that evening, is 0.15.

The probability that he bowls on a Thursday evening, given that Dina bowls on that evening, is 1. The probability that he bowls on a Thursday evening, given that Dina does not bowl on that evening, is 0.

Calculate the probability that, during a particular week:

8 (b) (i) Dina and Imran bowl on a Wednesday evening;

[2 marks]

Answer _____

8 (b) (ii) Dina and Imran bowl on both evenings;

[2 marks]

Answer _____

8 (b) (iii) Dina, but not Imran, bowls on a Thursday evening;

(1 mark)

Answer _____

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

9 A ball is thrown vertically downwards, at an initial speed of 2 m s^{-1}, from a point 5m above a fixed smooth horizontal surface. The ball then moves freely under gravity.

9 (a) Find the speed of the ball as it reaches the surface giving your answer in m s^{-1} to three significant figures.

[3 marks]

Answer _____ m s^{-1}

9 (b) The ball rebounds vertically upwards from the surface with an initial speed of 4 m s^{-1}

Find the time taken by the ball to reach its maximum height after rebounding giving your answer in seconds to three significant figures.

[3 marks]

Answer _____ seconds

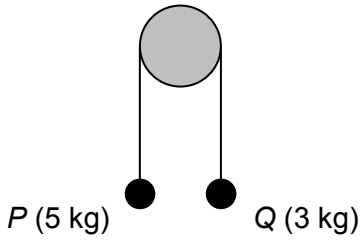
9 (c) Given that the ball has mass 0.1kg, find the impulse that the ball receives during its impact with the surface giving your answer in Ns to three significant figures.

[2 marks]

Answer _____ Ns

10 Two particles, P and Q, are connected by a string that passes over a fixed, smooth peg, as shown in the diagram. The mass of P is 5 kg and the mass of Q is 3 kg.

The particles are released from rest in the position shown, where P and Q are at the same level.



10 (a) By forming an equation of motion for each particle, show that the magnitude of the acceleration of the particles is 2.45 ms^{-2}.

[5 marks]

10 (b) Find the tension in the string.

[2 marks]

Answer _____ N

11 A particle moves in a straight line.

At time t seconds, where $t \geq 0$, it has velocity $(3t^2 - 2t - 5)$ m s^{-1}.

Find the acceleration of the particle when it comes instantaneously to rest.

[5 marks]

Answer _____ m s^{-2}

END OF QUESTIONS

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