

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

INTERNATIONAL A-LEVEL MATHEMATICS

(9660/MA04) Unit S2 – Statistics

Monday 10 June 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 for method may be lost.

For Examiner's Use	
Question	Mark
1	
2	
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9	
TOTAL	



J U N 1 9 M A 0 4 0 1

IB/M/Jun19/E10

MA04

1

[4 marks]

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Answer

4



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Turn over ►



2 The height, X , of the female adults in a city can be modelled by a normal distribution with mean 162 cm and standard deviation 5 cm

2 (a) Find the probability that a randomly selected female adult from the city has a height less than 152 cm

[2 marks]

Answer _____



- Of the male adults in the city, 5% have a height greater than 185 cm

- [4 marks]**

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

- Describe the distribution of $X + Y$.

[2 marks]

[illegible]

- 3** The continuous random variable T has cumulative distribution function

$$F(t) = \begin{cases} 0 & t \leq 0 \\ kt^4 & 0 < t \leq 5 \\ 1 & t > 5 \end{cases}$$

- 3 (a)** Show that $k = \frac{1}{625}$

[2 marks]

- 3 (b)** State $P(T = 3)$

[1 mark]

Answer _____



3 (c) The constant c is such that $P(T \leq c) = 0.75$

Find c .

Give your answer to four significant figures.

[2 marks]

Answer _____

5

Turn over for the next question

Turn over ►



- 4** The length, L cm, of bolts produced by a machine can be modelled by $L \sim N(3.5, 0.3^2)$
A random sample of n bolts is taken.

- 4 (a)** Given that $n = 20$, find $P(\bar{L} > 3.65)$

[4 marks]

Answer _____



4 (b) Given that $P(\bar{L} < 3.6) > 0.99$, find the minimum possible value of n .

[4 marks]

Answer _____

8

Turn over for the next question

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There is a new version of the computer game. The scores of a random sample of 100 players are recorded and are found to have a mean of 492 and a standard deviation of 38.2

[7 marks]

[illegible]

- 5 (b)** Explain why it is not necessary to assume that the scores have a normal distribution to carry out the test in part (a).

[2 marks]

Turn over for the next question

9

Turn over ►



6 A manufacturer produces light bulbs.

The lifetimes, in years, of six light bulbs in a random sample were

3.21 3.42 3.84 3.91 4.11 4.85

6 (a) Calculate:

6 (a) (i) the sample mean;

[1 mark]

Answer _____

6 (a) (ii) the sample variance.

[2 marks]

Answer _____



[7 marks]

[illegible]

10

- 7** Emily counts the number of cars, X , going past her house during a 10-minute interval.
- Emily believes that the distribution of X can be modelled by a Poisson distribution with mean 6.5

7 (a) Find $P(X = 4)$

[2 marks]

Answer _____

- 7 (b)** Emily also counts the number of lorries, Y , going past her house during a 10-minute interval.
- Emily believes that the distribution of Y can be modelled by a Poisson distribution with mean 0.5

Assume X and Y are independent.

7 (b) (i) Find the probability that the total number of cars and lorries going past Emily's house in 10 minutes is less than 3

[3 marks]

Answer _____



[6 marks]

[illegible]

Turn over ►



7 (b) (iii) Explain, in the context of the test in part **(b)(ii)**, the meaning of a Type I error.

[2 marks]

7 (b) (iv) Calculate the probability of making a Type I error in the test in part **(b)(ii)**.

[2 marks]

Answer _____

15



$$f(x) = \begin{cases} \frac{1}{32}x^3 & 0 < x \leq 2 \\ \frac{1}{8}x + \frac{1}{16} & 2 < x \leq 4 \\ 0 & \text{otherwise} \end{cases}$$

[3 marks]

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[5 marks]

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Answer _____

[2 marks]

Answer _____



[7 marks]

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Answer _____

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17

Turn over ►



9 A random sample X_1, X_2, X_3 and X_4 , is taken from a population with unknown mean μ .

9 (a) State whether or not

$$X_1 + 2X_2 + 3X_3 + 4X_4$$

is a statistic, giving a reason for your answer.

[2 marks]

9 (b) State whether or not

$$\frac{\sum_{i=1}^4 X_i^2}{4} - \mu^2$$

is a statistic, giving a reason for your answer.

[2 marks]

END OF QUESTIONS



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