

Please write clearly in block capitals.

Centre number

Candidate number

Surname

Forename(s)

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I declare this is my own work.

INTERNATIONAL A-LEVEL

MATHEMATICS

(9660/MA04) Unit S2 Statistics

Thursday 15 January 2026

07:00 UK Time

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.
- 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	
TOTAL	

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

- 1** A sheep has just been born on a farm. The time T in hours until the next sheep is born is modelled by an exponential distribution with a mean of 8 hours.

- 1 (a)** Find $P(T < 4)$

Give your answer to four significant figures.

[2 marks]

Answer _____

- 1 (b)** Find $P(3 < T < 10)$

Give your answer to four significant figures.

[2 marks]

Answer _____



- 1 (c) Find the value of t for which $P(T > t) = 0.2$

Give your answer to three significant figures.

[2 marks]

Answer _____

- 1 (d) Find the variance of T

[1 mark]

Answer _____

- 1 (e) Sally works on the farm for 12 hours each day.

On a given day that Sally works, no sheep are born during the first 9 hours.

Find the probability that Sally will complete her 12 hours for this day without a sheep being born.

Give your answer to three significant figures.

[2 marks]

Answer _____



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- 2** The continuous random variable X has a probability density function $f(x)$ defined by

$$f(x) = \begin{cases} \frac{3}{1072} \sqrt{5x+6} & 2 \leq x \leq a \\ 0 & \text{otherwise} \end{cases}$$

where $a > 2$

- 2 (a)** Find the value of a

[4 marks]

$a =$ _____

- 2 (b)** State the value of $P(X = a)$

[1 mark]

Answer _____



- 3** At a doctor's surgery past records show that 15% of appointments are missed by patients.
- There are 30 appointments available on each workday. Every appointment is taken each workday.
- Assume that each appointment missed is independent of all other appointments.

- 3 (a)** Find the probability that none of the patients miss their appointment at the doctor's surgery on a randomly chosen workday.

Give your answer to three significant figures.

[2 marks]

Answer _____



[6 marks]

[illegible]

[1 mark]

- 4** A student is collecting data on the number of cars arriving at a car park.
- The random variable X denotes the number of cars arriving in a randomly selected one-minute interval.

- 4 (a)** State **two** assumptions necessary for a Poisson distribution to model the distribution of X

[2 marks]

Assumption 1 _____

Assumption 2 _____

- 4 (b)** The data collected by the student for the number of cars arriving x in each of 50 randomly selected one-minute intervals is shown in **Figure 1**.

Figure 1

x	0	1	2	3	4	5	6	7 or greater
frequency	4	7	12	12	6	5	4	0

- 4 (b) (i)** Find the sample mean $\bar{x}$ and the unbiased estimate of the variance s^2 for the student's data.

[3 marks]

$$\bar{x} = \underline{\hspace{2cm}} \quad s^2 = \underline{\hspace{2cm}}$$



- 4 (b) (ii)** Use your answer from **part (b)(i)** to comment on the suitability of modelling X as a Poisson distribution.

[1 mark]

- 4 (c)** Over a number of weeks X is found to have a mean of 2.9 for a one-minute interval.

The random variable Y denotes the number of cars leaving the car park in a one-minute interval.

Over a number of weeks Y is found to have a mean of 3.6 for a one-minute interval.

Assume X and Y have independent Poisson distributions.

Let T denote the random variable for the total number of cars entering and leaving the car park in a one-minute interval.

It is given that $T \sim \text{Po}(\lambda)$

- 4 (c) (i)** Find the value of λ

[1 mark]

$\lambda =$ _____

- 4 (c) (ii)** It is given that $P(b < T < 14) = 0.7692$ correct to four significant figures.

Find the value of b

[3 marks]

$b =$ _____

10

Turn over ►



- 5** The continuous random variable X has a probability density function $f(x)$ defined by

$$f(x) = \begin{cases} \frac{1}{2}x^2 & 0 \leq x < 1 \\ \frac{1}{54}(35 - 8x) & 1 \leq x < 4 \\ 0 & \text{otherwise} \end{cases}$$

- 5 (a)** Find $P(X > 0.5)$

[2 marks]

Answer _____

- 5 (b)** Find the exact value of $E(X)$

[3 marks]

Answer _____



[4 marks]

[illegible]

[2 marks]

Answer _____

Turn over for the next question

Turn over ►



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- 6** The continuous random variable T has cumulative distribution function $F(t)$ defined by

$$F(t) = \begin{cases} 0 & t < 2 \\ 1 - \frac{t}{32}(t-6)^2 & 2 \leq t \leq c \\ 1 & t > c \end{cases}$$

where c is a constant.

- 6 (a)** State the value of c

[1 mark]

$c =$ _____

- 6 (b)** The probability density function of T is $f(t)$

Find $f(t)$

[3 marks]

$$f(t) = \left\{ \begin{array}{l} \text{.....} \\ \text{.....} \end{array} \right.$$



The company claims that the population mean lifetime of the LED lights has changed.

[7 marks]

[illegible]

- 7 (b)** It is found that the company incorrectly calculated the unbiased estimate of the population standard deviation s used in the hypothesis test in **part (a)**.

The correct value for s is greater than 18 hours.

Explain if this would change your conclusion to the hypothesis test in **part (a)**.

[2 marks]

- 7 (c)** Explain why it was not necessary to assume that the lifetimes of the LED lights are normally distributed to carry out the test in **part (a)**.

[2 marks]

Turn over for the next question

Turn over ►



- 8** A water supply company checks the water for the number of harmful bacteria in randomly selected 10 ml samples of water.
- It is assumed that the number of harmful bacteria in 10 ml samples of water occur randomly with a mean of 15
- Following a recent burst pipe the water supply company claims that the mean number of harmful bacteria in 10 ml samples of water has changed.
- The water company tests this claim by performing a hypothesis test.

- 8 (a)** State the null and alternative hypotheses needed to test the water company's claim.

[1 mark]

- 8 (b)** Find the critical region for a 10% level of significance.

Use probabilities to justify your answer.

[4 marks]

Answer _____



- 8 (c)** The number of harmful bacteria found by the water supply company in a randomly selected sample of 10 ml of water was found to be 22

Use your answers to **part (a)** and **part (b)** to determine the conclusion of the hypothesis test at the 10% level of significance.

[2 marks]

- 8 (d)** Describe what is meant by a Type II error in the context of the water company's hypothesis test.

[1 mark]

8

Turn over for the next question

Turn over ►



A random sample of size n is taken from X_1 such that $P(\bar{X}_1 > 182) > 0.9$

[4 marks]

$n =$ _____

A continuous random variable X_3 is normally distributed with a mean of 370 and a variance of σ^2

The random variables X_1 , X_2 and X_3 are independent of each other.

The random variable X_T is such that $X_T = X_1 + X_2 + X_3$

It is given that $P(X_T < 750) = 0.95$ and $P(X_T > 650) = 0.98$

Find the value of μ and the value of σ

Give your values to three significant figures.

[9 marks]



[illegible]
$$\mu = \underline{\hspace{2cm}} \qquad \sigma = \underline{\hspace{2cm}}$$

END OF QUESTIONS

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