OXFORD AQA

INTERNATIONAL QUALIFICATIONS

Please write clearly in block capitals.

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

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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	

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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 $\mathrm{P}(T < 4)$

Give your answer to four significant figures.

[2 marks]

Answer _____

1 (b) Find $\mathrm{P}(3 < T < 10)$

Give your answer to four significant figures.

[2 marks]

Answer _____

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1 (c) Find the value of t for which $\mathrm{P}(T > t) = 0.2$

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 _____

9

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2 The continuous random variable X has a probability density function $\mathrm{f}(x)$ defined by

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

where $a > 2$

2 (a) Find the value of a

[4 marks]

$a =$ _____

2 (b) State the value of $\mathrm{P}(X = a)$

[1 mark]

Answer _____

5

Turn over ►

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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 _____

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3 (b) The doctor's surgery introduces a new computer system designed to decrease the proportion of appointments missed each workday.

On a randomly chosen workday the doctor's surgery has 1 appointment missed.

Use the 5% level of significance to test whether the new computer system has decreased the proportion of appointments missed.

[6 marks]

3 (c) Describe what is meant by a Type I error in the context of the test in **part (b)**.

[1 mark]

9

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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 $\overline{x}$ and the unbiased estimate of the variance s^2 for the student's data.

[3 marks]

$\overline{x} =$ _____ $s^2 =$ _____

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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 $\text{P}(b < T < 14) = 0.7692$ correct to four significant figures.

Find the value of b

[3 marks]

$b =$ _____

10

Turn over ►

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5 The continuous random variable X has a probability density function $\mathrm{f}(x)$ defined by

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

5 (a) Find $\mathrm{P}(X > 0.5)$

[2 marks]

Answer _____

5 (b) Find the exact value of $\mathrm{E}(X)$

[3 marks]

Answer _____

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5 (c) Show that $\text{Var}(X) = \frac{721}{960}$

[4 marks]

5 (d) Find the exact value of $\text{Var}(4 - 3X)$

[2 marks]

Answer _____

11

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6 The continuous random variable T has cumulative distribution function $\mathrm{F}(t)$ defined by

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

where c is a constant.

6 (a) State the value of c

[1 mark]

$c =$ _____

6 (b) The probability density function of T is $\mathrm{f}(t)$

Find $\mathrm{f}(t)$

[3 marks]

$$\mathrm{f}(t) = \begin{cases} \text{.....} \\ \\ \text{.....} \end{cases}$$

4

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7 A company makes LED lights which have a known population mean lifetime of 2000 hours.

Following a change in some of the parts used to make the LED lights, a random sample of 40 LED lights are tested.

The 40 LED lights are found to have a mean lifetime of 1995 hours and an unbiased estimate of the population standard deviation s of 18 hours.

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

7 (a) Use the 5% level of significance to test the company's claim.

[7 marks]

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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]

11

Turn over for the next question

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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 _____

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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

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9 A continuous random variable X_1 is normally distributed with a mean of 185 and a variance of 400

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

9 (a) Find the smallest possible value of n

[4 marks]

$n =$ _____

9 (b) A continuous random variable X_2 is normally distributed with a mean of μ and a variance of 225

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 $X_\mathrm{T} = X_1 + X_2 + X_3$

It is given that $\mathrm{P}\left(X_\mathrm{T} < 750\right) = 0.95$ and $\mathrm{P}\left(X_\mathrm{T} > 650\right) = 0.98$

Find the value of μ and the value of σ

Give your values to three significant figures.

[9 marks]

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$\mu =$ _____ $\sigma =$ _____

13

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