

Please write clearly, in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

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Candidate signature

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# AS

# FURTHER MATHEMATICS

## Paper 2 – Statistics

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Exam Date

Morning

Time allowed: 1 hour 30 minutes

### Materials

For this paper you must have:

- You must ensure you have the other optional question paper/answer booklet for which you are entered (**either** Mechanics **or** Discrete). You will have 1 hour 30 minutes to complete both papers.
- The AQA booklet of formulae and statistical tables.
- You may use a graphics calculator.

### Instructions

- Use black ink or black ball-point pen. Pencil should be used for drawing.
- Answer **all** questions.
- You must answer each question in the space provided for that question. If you require extra space, use an AQA supplementary answer book; do **not** use the space provided for a different question.
- Do not write outside the box 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.

### Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 40.

### Advice

Unless stated otherwise, you may quote formulae, without proof, from the booklet.

You do not necessarily need to use all the space provided.

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

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- 1 The random variable  $T$  has probability density defined by

$$f(t) = \begin{cases} \frac{t}{8} & 0 \leq t \leq k \\ 0 & \text{otherwise} \end{cases}$$

Find the value of  $k$

[1 mark]

$$\frac{1}{16}$$

$$\frac{1}{4}$$

4

16

- 2 The discrete random variable  $X$  has probability distribution defined by

$$P(X = x) = \begin{cases} 0.1 & x = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 \\ 0 & \text{otherwise} \end{cases}$$

Find the value of  $P(4 \leq X \leq 7)$

Circle your answer.

[1 mark]

0.2

0.3

0.4

0.5

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**4** The number of printers,  $V$ , bought during one day from the *Verigood* store can be modelled by a Poisson distribution with mean 4.5

The number of printers,  $W$ , bought during one day from the *Winnerprint* store can be modelled by a Poisson distribution with mean 5.5

**4 (a)** Find the probability that the total number of printers bought during one day from *Verigood* and *Winnerprint* stores is greater than 10.

**[2 marks]**

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**4 (b)** State the circumstance under which the distributional model you used in part **(a)** would not be valid.

**[1 mark]**

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- 5 Participants in a school jumping competition gain a total score for each jump based on the length,  $L$  metres, jumped beyond a fixed point and a mark,  $S$ , for style.

$L$  may be regarded as a continuous random variable with probability density function

$$f(l) = \begin{cases} wl & 0 \leq l \leq 15 \\ 0 & \text{otherwise} \end{cases}$$

where  $w$  is a constant.

$S$  may be regarded as a discrete random variable with probability function

$$P(S = s) = \begin{cases} \frac{1}{15}s & s = 1, 2, 3, 4, 5 \\ 0 & \text{otherwise} \end{cases}$$

Assume that  $L$  and  $S$  are independent.

The total score for a participant in this competition,  $T$ , is given by  $T = L^2 + \frac{1}{2}S$

Show that the expected total score for a participant is  $114\frac{1}{3}$

[5 marks]

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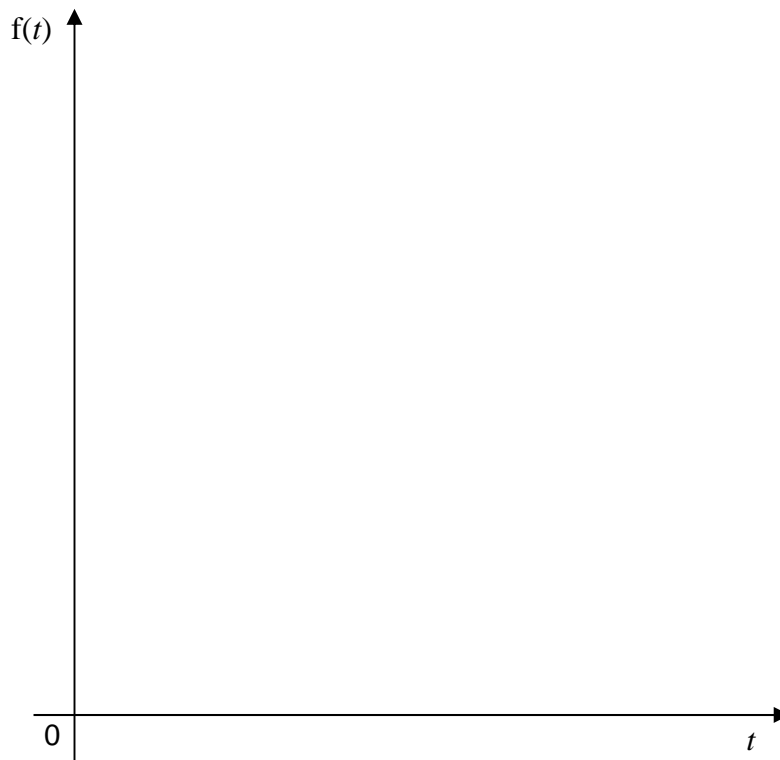


- 6 The continuous random variable  $T$  has probability density function defined by

$$f(t) = \begin{cases} \frac{1}{3} & 0 \leq t \leq \frac{3}{2} \\ \frac{9-2t}{18} & \frac{3}{2} \leq t \leq \frac{9}{2} \\ 0 & \text{otherwise} \end{cases}$$

- 6 (a) (i) Sketch this probability density function below.

[2 marks]



- 6 (a) (ii) State the median of  $T$ .

[1 mark]

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6 (b) (i) Find  $E(T)$

[2 marks]

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6 (b) (ii) Given that  $E(T^2) = \frac{15}{4}$ , find  $\text{Var}(4T - 5)$

[3 marks]

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Turn over for the next question

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- 7 A dairy industry researcher, Robyn, decided to investigate the milk yield, classified as low, medium or high, obtained from four different breeds of cow, A, B, C and D.

The milk yield of a sample of 105 cows was monitored and the results are summarised in contingency **Table 1**.

		Yield			
		Low	Medium	High	Total
Breed	A	4	5	12	21
	B	10	6	4	20
	C	8	17	7	32
	D	5	20	7	32
Total		27	48	30	105

The sample of cows may be regarded as random.

Robyn decides to carry out a  $\chi^2$ -test for association between milk yield and breed using the information given in **Table 1**.

- 7 (a) Contingency **Table 2** gives some of the expected frequencies for this test.

Complete **Table 2** with the missing expected values.

[2 marks]

Table 2		Yield		
		Low	Medium	High
Breed	A			6
	B	5.14	9.14	5.71
	C			
	D	8.23	14.63	9.14





**8 (b)** For your test carried out in part **(a)** state, in context, the meaning of a Type II error.

**[1 mark]**

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**8 (c)** State **one** advantage and **one** disadvantage of using a 1% significance level rather than a 5% level of significance in a hypothesis test.

**[2 marks]**

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**END OF QUESTIONS**