



# Cambridge International AS & A Level

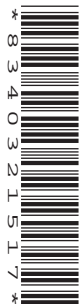
CANDIDATE  
NAME

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## FURTHER MATHEMATICS

9231/42

Paper 4 Further Probability & Statistics

October/November 2022

1 hour 30 minutes

You must answer on the question paper.

You will need: List of formulae (MF19)

### INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- If additional space is needed, you should use the lined page at the end of this booklet; the question number or numbers must be clearly shown.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

### INFORMATION

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages.

- 1 A basketball club has a large number of players. The heights,  $x$  m, of a random sample of 10 of these players are measured. A 90% confidence interval for the population mean height,  $\mu$  m, of players in this club is calculated. It is assumed that heights are normally distributed. The confidence interval is  $1.78 \leq \mu \leq 2.02$ .

Find the values of  $\sum x$  and  $\sum x^2$  for this sample.

[6]

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## 3

- 2 In the colleges in three regions of a particular country, students are given individual targets to achieve. Their performance is measured against their individual target and graded as 'above target', 'on target' or 'below target'. For a random sample of students from each of the three regions, the observed frequencies are summarised in the following table.

		Region			Total
		<i>A</i>	<i>B</i>	<i>C</i>	
Performance	Above target	62	41	44	147
	On target	102	94	95	291
	Below target	56	45	61	162
Total		220	180	200	600

Test, at the 10% significance level, whether performance is independent of region.

[7]

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- 4 The continuous random variable  $X$  has probability density function  $f$  given by

$$f(x) = \begin{cases} k & 0 \leq x < 1, \\ kx & 1 \leq x \leq 2, \\ 0 & \text{otherwise,} \end{cases}$$

where  $k$  is a constant.

- (a) Show that  $k = \frac{2}{5}$ . [1]

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- (b) Find the interquartile range of  $X$ . [5]

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5 A 6-sided dice,  $A$ , with faces numbered 1, 2, 3, 4, 5, 6 is biased so that the probability of throwing a 6 is  $\frac{1}{4}$ . The random variable  $X$  is the number of 6s obtained when dice  $A$  is thrown twice.

(a) Find the probability generating function of  $X$ . [2]

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A second dice,  $B$ , with faces numbered 1, 2, 3, 4, 5, 6 is unbiased. The random variable  $Y$  is the number of 6s obtained when dice  $B$  is thrown twice.

The random variable  $Z$  is the total number of 6s obtained when both dice are thrown twice.

(b) Find the probability generating function of  $Z$ , expressing your answer as a polynomial. [3]

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(c) Find  $\text{Var}(Z)$ . [3]

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(d) Use the probability generating function of  $Z$  to find the most probable value of  $Z$ . [1]

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(b) Explain whether a paired sample *t*-test would be appropriate to test the manager's claim if earnings are normally distributed. [1]

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