



# Cambridge International AS & A Level

CANDIDATE  
NAME

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CENTRE  
NUMBER

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## FURTHER MATHEMATICS

9231/43

Paper 4 Further Probability & Statistics

May/June 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.





- 3 George throws two coins,  $A$  and  $B$ , at the same time. Coin  $A$  is biased so that the probability of obtaining a head is  $a$ . Coin  $B$  is biased so that the probability of obtaining a head is  $b$ , where  $b < a$ . The probability generating function of  $X$ , the number of heads obtained by George, is  $G_X(t)$ . The coefficients of  $t$  and  $t^2$  in  $G_X(t)$  are  $\frac{5}{12}$  and  $\frac{1}{12}$  respectively.

(a) Find the value of  $a$ . [2]

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The random variable  $Y$  is the sum of two independent observations of  $X$ .

(b) Find the probability generating function of  $Y$ , giving your answer as a polynomial in  $t$ . [3]

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

$$f(x) = \begin{cases} \frac{3}{8} \left(1 + \frac{1}{x^2}\right) & 1 \leq x \leq 3, \\ 0 & \text{otherwise.} \end{cases}$$

(a) Find  $E(\sqrt{X})$ . [3]

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The random variable  $Y$  is given by  $Y = X^2$ .

(b) Find the probability density function of  $Y$ . [4]

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(c) Find the 40th percentile of  $Y$ .

[3]





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