

Cambridge International AS & A Level

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		

2 6 3 2 5 8 3 5 0 4

FURTHER MATHEMATICS

9231/43

Paper 4 Further Probability & Statistics

October/November 2020

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. Blank pages are indicated.

	$\sum x = 242.0$	$\sum x^2 = 1587.0$	$\sum y = 373.2$	$\sum y^2 = 2532.6$
Find a 90% forests X and	confidence interva			pulation mean lengths of lea
•••••				
			······································	
•••••				

For a random sample of 9 rods, the breaking strengths, measured in tonnes, were as follows.

Metal rods produced by a certain factory are claimed to have a median breaking strength of 200 tonnes.

2

		210	186	188	208	184	191	215	198	196		
	cientist believe tonnes.	es that th	e media	ın break	king stre	ength of	metal r	ods pro	duced b	y this fac	tory is less	than
(a)	Use a Wilcox support the so				the 5%	signific	ance le	evel, to	test whe	ther there	e is evidenc	ce to [6]
									••••			
(b)	Give a reason	n why a	Wilcox	on sign	ned-rank	test is	prefera	able to a	a sign te	est, when	both are v	alid. [1]

3 Apples are sold in bags of 5. Based on her previous experience, Freya claims that the probability of any apple weighing more than 100 grams is 0.35, independently of other apples in the bag.

The apples in a random sample of 150 bags are checked and the number, x, in each bag weighing more than 100 grams is recorded. The results are shown in the following table.

x	0	1	2	3	4	5
Frequency	12	39	46	37	12	4

Carry out a goodness of fit test at the 5% significance level and hence comment on Freya's claim. [7]

4 Members of the Sprints athletics club have been taking part in an intense training scheme, aimed at reducing their times taken to run 400 m. For a random sample of 9 athletes from the club, the times taken, in seconds, before and after the training scheme are given in the following table.

Athlete	A	В	С	D	E	F	G	Н	I
Time before	48.8	48.2	50.3	49.6	49.4	48.9	47.6	50.3	48.4
Time after	47.9	47.8	49.6	49.1	49.6	48.9	47.7	49.1	48.1

The organiser of the training scheme claims that on average an athlete's time will be reduced by at least 0.3 seconds.

Test at the 10% significance level whether the organiser's claim is justified, stating any assumption that you make. [8]

(a)	Find the probability generating function $G_X(t)$ of X .	
coin	san has three coins, two of which are biased so that the probability of obtaining a head is tossed is $\frac{1}{3}$. The corresponding probability for the third coin is $\frac{1}{4}$. The number of heads Hassan when he tosses these three coins is denoted by Y .	
(b)	Find the probability generating function $G_Y(t)$ of Y .	
The	random variable Z is the total number of heads obtained by Keira and Hassan.	
	random variable <i>Z</i> is the total number of heads obtained by Keira and Hassan. Find the probability generating function of <i>Z</i> , expressing your answer as a polynomial.	

[2]
Z. [1]

6	The	e continuous random variable X has cumulative distribution function F given by									
		$F(x) = \begin{cases} 0 \\ \frac{1}{60} (16x - x^2) \\ 1 \end{cases}$	$x < 0,$ $0 \le x \le 6,$ $x > 6.$								
	(a)	Find the interquartile range of X .	[4]								

Find $E(X^3)$.	[4]

© UCLES 2020 9231/43/O/N/20

(b)

		••
		••
		••
		••
		••
The	random variable Y is such that $Y = \sqrt{X}$.	
(c)	Find the probability density function of <i>Y</i> .	3]
		••
		••
		••
		••
		••
		••
		••
		••
		••
		••
		••
		••
		••

Additional Page

If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.		

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.