

Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson Edexcel  
Level 3 GCE**

Centre Number

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**Wednesday 22 May 2019**

Morning

Paper Reference **8MA0-21**

**Mathematics  
Advanced Subsidiary  
Paper 21: Statistics**

**You must have:**

Mathematical Formulae and Statistical Tables, calculator

Total Marks

**Candidates may use any calculator allowed by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.**

### Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Answers should be given to three significant figures unless otherwise stated.

### Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- The total mark for this part of the examination is 30. There are 5 questions.
- The marks for **each** question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*

### Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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4. Joshua is investigating the daily total rainfall in Hurn for May to October 2015

Using the information from the large data set, Joshua wishes to calculate the mean of the daily total rainfall in Hurn for May to October 2015

- (a) Using your knowledge of the large data set, explain why Joshua needs to clean the data before calculating the mean.

(1)

Using the information from the large data set, he produces the grouped frequency table below.

| Daily total rainfall ( $r$ mm) | Frequency | Midpoint ( $x$ mm) |
|--------------------------------|-----------|--------------------|
| $0 \leq r < 0.5$               | 121       | 0.25               |
| $0.5 \leq r < 1.0$             | 10        | 0.75               |
| $1.0 \leq r < 5.0$             | 24        | 3.0                |
| $5.0 \leq r < 10.0$            | 12        | 7.5                |
| $10.0 \leq r < 30.0$           | 17        | 20.0               |

You may use  $\sum fx = 539.75$  and  $\sum fx^2 = 7704.1875$

- (b) Use linear interpolation to calculate an estimate for the upper quartile of the daily total rainfall.

(2)

- (c) Calculate an estimate for the standard deviation of the daily total rainfall in Hurn for May to October 2015

(2)

- (d) (i) State the assumption involved with using class midpoints to calculate an estimate of a mean from a grouped frequency table.

- (ii) Using your knowledge of the large data set, explain why this assumption does not hold in this case.

- (iii) State, giving a reason, whether you would expect the actual mean daily total rainfall in Hurn for May to October 2015 to be larger than, smaller than or the same as an estimate based on the grouped frequency table.

(3)

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5. Past records show that 15% of customers at a shop buy chocolate. The shopkeeper believes that moving the chocolate closer to the till will increase the proportion of customers buying chocolate.

After moving the chocolate closer to the till, a random sample of 30 customers is taken and 8 of them are found to have bought chocolate.

Julie carries out a hypothesis test, at the 5% level of significance, to test the shopkeeper's belief.

Julie's hypothesis test is shown below.

$$H_0 : p = 0.15$$

$$H_1 : p \geq 0.15$$

Let  $X$  = the number of customers who buy chocolate.

$$X \sim B(30, 0.15)$$

$$P(X = 8) = 0.0420$$

$$0.0420 < 0.05 \text{ so reject } H_0$$

There is sufficient evidence to suggest that the proportion of customers buying chocolate has increased.

- (a) Identify the first two errors that Julie has made in her hypothesis test. (2)
- (b) Explain whether or not these errors will affect the conclusion of her hypothesis test. Give a reason for your answer. (1)
- (c) Find, using a 5% level of significance, the critical region for a one-tailed test of the shopkeeper's belief. The probability in the tail should be less than 0.05 (2)
- (d) Find the actual level of significance of this test. (1)









