

Please check the examination details below before entering your candidate information

Candidate surname		Other names	
Centre Number		Candidate Number	
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**Pearson Edexcel Level 3 GCE**

**Thursday 23 May 2024**

Afternoon

Paper reference **8MA0/21**

**Mathematics**  
**Advanced Subsidiary**  
**PAPER 21: Statistics**

**You must have:**  
 Mathematical Formulae and Statistical Tables (Green), 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.
- Values from statistical tables should be quoted in full. If a calculator is used instead of tables the value should be given to an equivalent degree of accuracy.
- Inexact 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.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.
- Check your answers if you have time at the end.

Turn over ►

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1. A coach recorded the heights of some adult rugby players and found the following summary statistics.

$$\text{Median} = 1.85 \text{ m}$$

$$\text{Range} = 0.28 \text{ m}$$

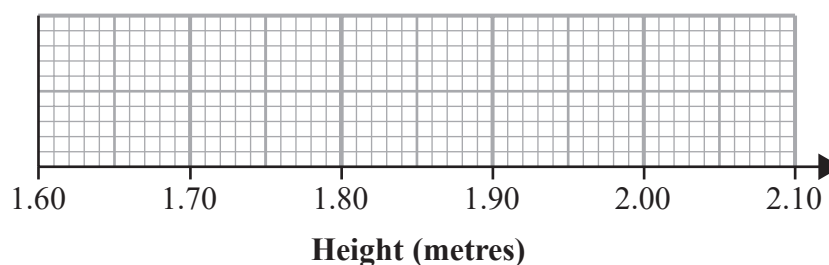
$$\text{Interquartile range} = 0.11 \text{ m}$$

The coach also noticed that

- the height of the shortest player is 1.72 m
- 25% of the players' heights are below the height of a player whose height is 1.81 m

Draw a box and whisker plot to represent this information on the grid below.

(4)



Use the spare grid on page 3 if you need to redraw your box and whisker plot.

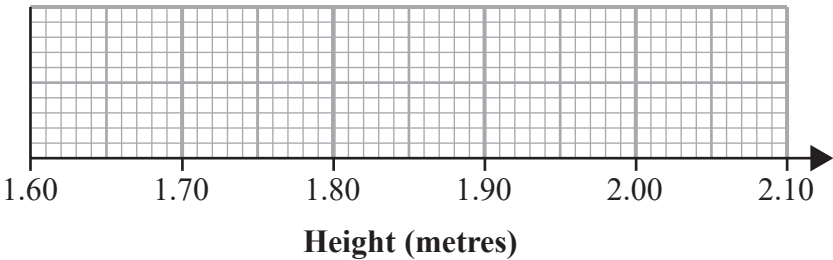


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Question 1 continued

Handwriting practice area with horizontal lines.

Only use this grid if you need to redraw your box and whisker plot.



(Total for Question 1 is 4 marks)

2. Keith is studying the variable Daily Mean Wind Direction, in degrees, from the large data set.

Keith summarised the data for Camborne from 1987 into 4 directions  $A$ ,  $B$ ,  $C$  and  $D$  representing North, South, East and West in some order.

Direction	$A$	$B$	$C$	$D$
Frequency	22	48	56	58

- (a) Using your knowledge of the large data set state, giving a reason, which direction  $A$  represents.

(1)

The entry for Hurn on 27th September 1987 was 999

- (b) State, giving a reason, what Keith should do with this value.

(2)



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Question 2 continued

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(Total for Question 2 is 3 marks)



3. Customers in a shop have to queue to pay.

The partially completed table below and partially completed histogram opposite, give information about the time,  $x$  minutes, spent in the queue by each of 112 customers one day.

Time in queue ( $x$ minutes)	Frequency
1–2	64
2–3	
3–4	13
4–6	
6–8	3

No customer spent less than 1 minute or longer than 8 minutes in the queue.

(a) Complete the table.

(2)

(b) Complete the histogram.

(2)

Ting decides to model the **frequency density** for these 112 customers by a curve with equation

$$y = \frac{k}{x^2} \quad 1 \leq x \leq 8$$

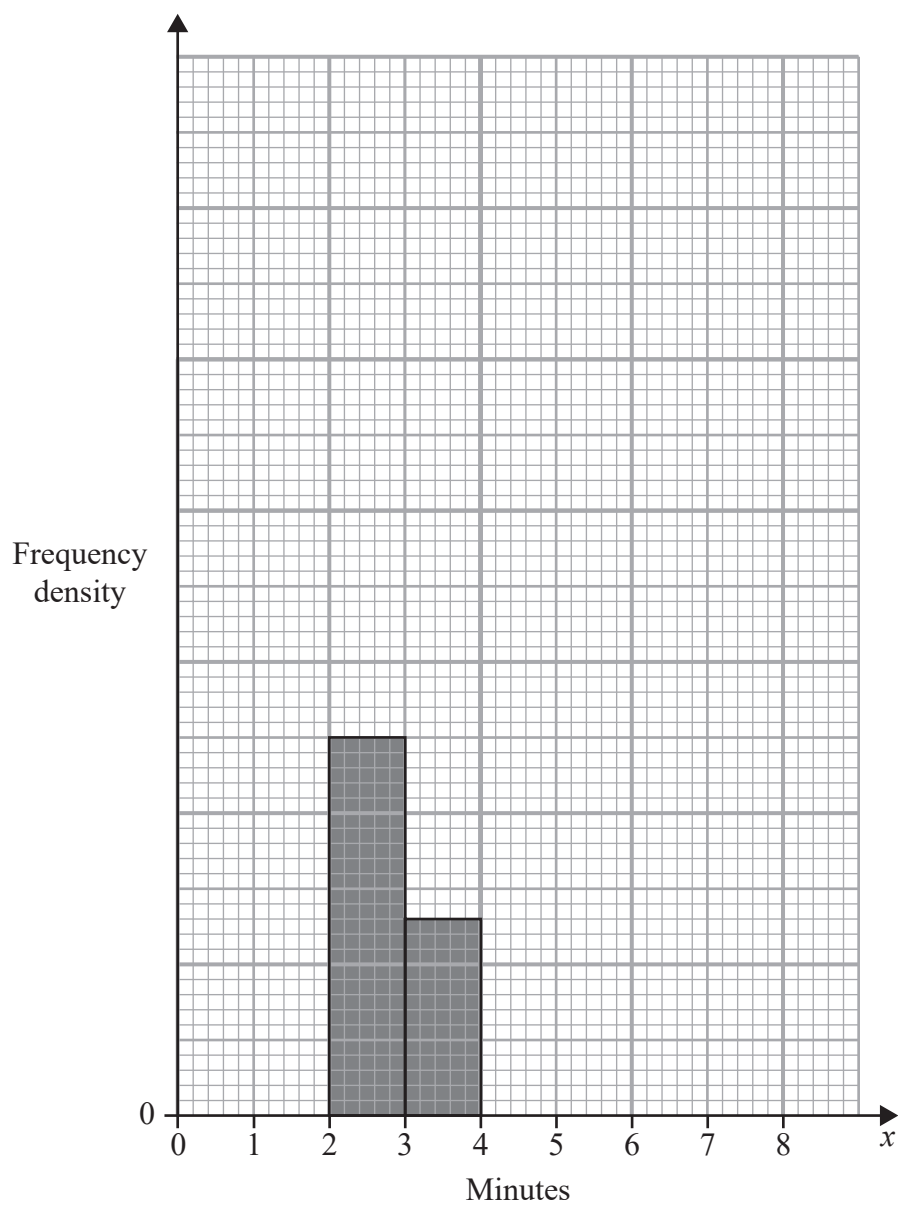
where  $k$  is a constant.

(c) Find the value of  $k$

(3)



Question 3 continued



Turn over for a spare grid if you need to redraw your histogram.



Question 3 continued

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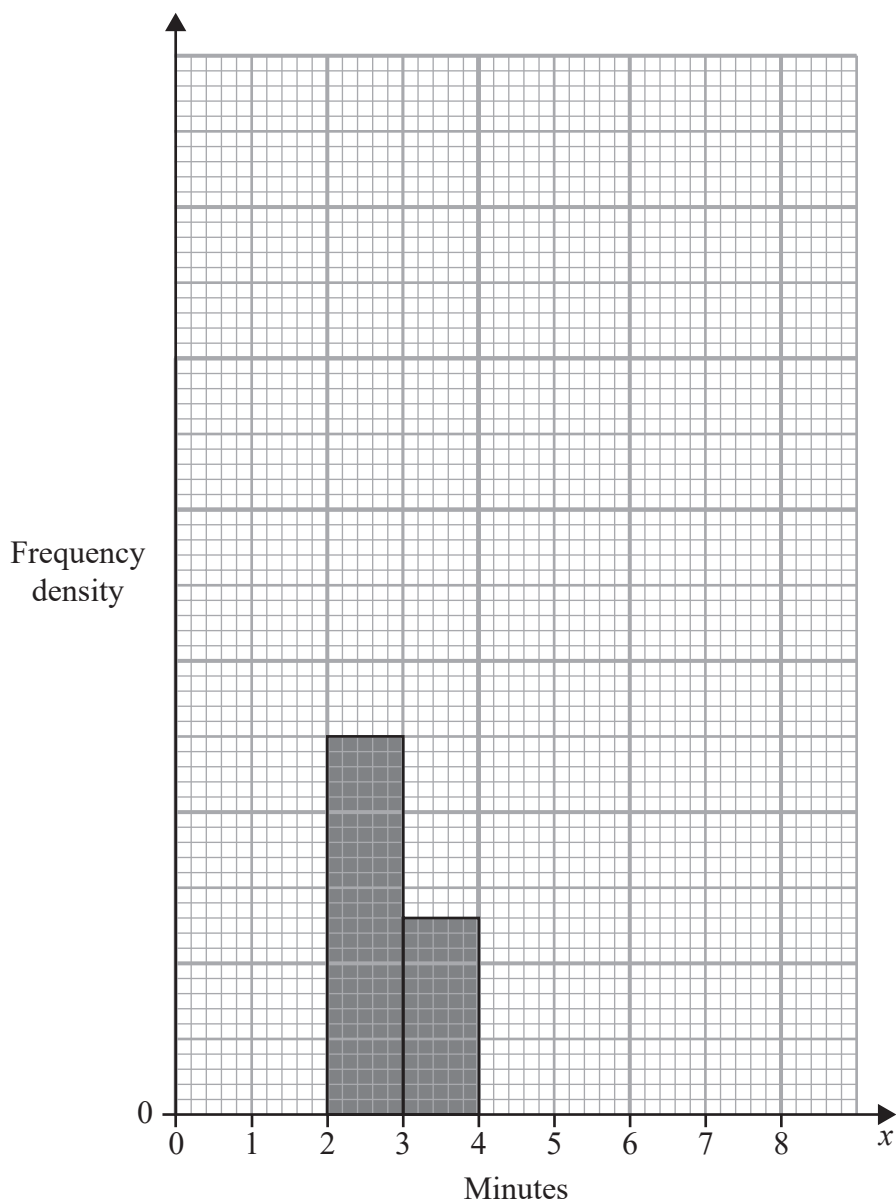




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Question 3 continued

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(Total for Question 3 is 7 marks)



4. The random variable  $X \sim B(27, 0.35)$

- (a) Find
- (i)  $P(X = 10)$
  - (ii)  $P(12 \leq X < 15)$

(3)

Historical records show that the proportion of defective items produced by a machine is 0.12

Following a maintenance service of the machine, a random sample of 60 items is taken and 3 defective items are found.

- (b) Carry out a suitable test to determine whether the proportion of defective items produced by the machine has decreased following the maintenance service. You should state your hypotheses clearly and use a 5% level of significance.

(4)

- (c) Write down the  $p$ -value for your test in part (b)

(1)

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Question 4 continued

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Question 4 continued

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Question 4 continued

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(Total for Question 4 is 8 marks)



- 5.** A biased 4-sided spinner has the numbers 6, 7, 8 and 10 on it.

The discrete random variable  $X$  represents the score when the spinner is spun once and has the following probability distribution,

$x$	6	7	8	10
$P(X=x)$	0.5	0.2	$q$	$q$

where  $q$  is a probability.

- (a) Find the value of  $q$  (1)

Karen spins the spinner repeatedly until she **either** gets a 7 **or** she has taken 4 spins.

- (b) Show that the probability that Karen stops after taking her 3rd spin is 0.128 (2)

The random variable  $S$  represents the number of spins Karen takes.

- (c) Find the probability distribution for  $S$  (4)

The random variable  $N$  represents the number of times Karen gets a 7

- (d) Find  $P(S > N)$  (1)



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Question 5 continued

Lined area for writing the answer to Question 5.



**Question 5 continued**

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**(Total for Question 5 is 8 marks)**

**TOTAL FOR STATISTICS IS 30 MARKS**

