

Surname						Other Names					
Centre Number						Candidate Number					
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General Certificate of Secondary Education  
June 2005



**STATISTICS**  
**Higher Tier**

3311/H

Friday 24 June 2005 9.00 am to 11.30 am

**H**

<p><b>In addition to this paper you will require:</b></p> <ul style="list-style-type: none"> <li>• a calculator</li> <li>• mathematical instruments.</li> </ul>	
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For Examiner's Use	
Pages	Mark
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 – 17	
18 – 19	
20 – 21	
22 – 23	
24	
TOTAL	
Examiner's Initials	

Time allowed: 2 hours 30 minutes

**Instructions**

- Use blue or black ink or ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this booklet.

**Information**

- The maximum mark for this paper is 120.
- Mark allocations are shown in brackets.
- Additional answer paper and graph paper will be issued on request and must be tagged securely to this answer booklet.
- You are expected to use a calculator where appropriate.

**Advice**

- In all calculations, show clearly how you work out your answer.

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You may need to use the following formulae:

$$\text{Mean of a frequency distribution} = \frac{\sum fx}{\sum f}$$

$$\text{Mean of a grouped frequency distribution} = \frac{\sum fx}{\sum f}, \quad \text{where } x \text{ is the mid-interval value.}$$

Standard deviation for a set of numbers  $x_1, x_2, \dots, x_n$  having a mean value of  $\bar{x}$  is given by

$$\sqrt{\frac{\sum (x - \bar{x})^2}{n}} \quad \text{or} \quad \sqrt{\frac{\sum x^2}{n} - \bar{x}^2}$$

Standard deviation for a frequency distribution

$$\sqrt{\frac{\sum f(x - \bar{x})^2}{\sum f}} \quad \text{or} \quad \sqrt{\frac{\sum fx^2}{\sum f} - \bar{x}^2}$$

The same formula applies to the standard deviation of a grouped frequency distribution where  $x$  is the mid-interval value.

$$\text{Spearman's rank correlation coefficient} = 1 - \frac{6\sum d^2}{n(n^2 - 1)}$$

Answer **all** questions in the spaces provided.

1 A travel agent decides to survey all existing customers using a postal questionnaire.

(a) One question is shown below.

‘How much do you spend each year on holidays abroad?’

Please tick one box.

£1000 - £1500	<input type="checkbox"/>
£1500 - £2000	<input type="checkbox"/>
£2000 - £3500	<input type="checkbox"/>
£3500 - £6000	<input type="checkbox"/>
£6000 and over	<input type="checkbox"/>

Give **two** distinct criticisms of the response section of this question.

Criticism 1 .....

Criticism 2 .....

(2 marks)

(b) Of 2000 questionnaires posted out, only 93 were returned.

Give **two** ways in which the response rate could be increased.

1 .....

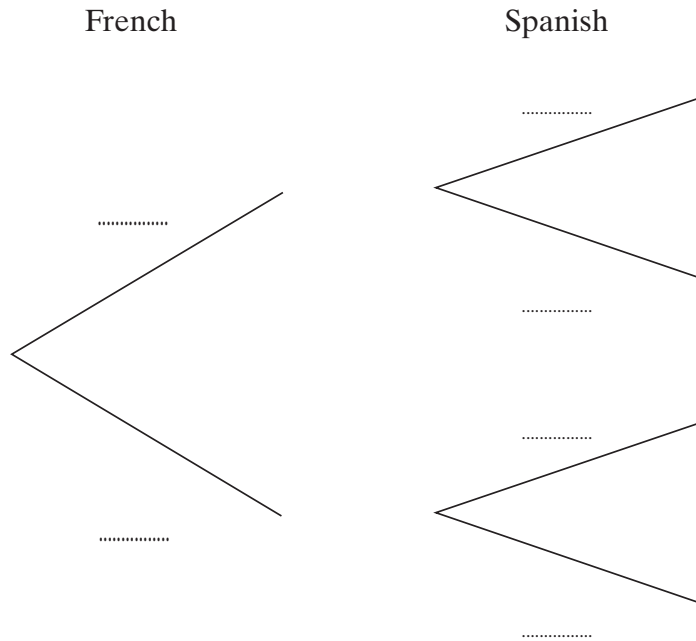
2 .....

(2 marks)

Turn over

- 2 All students at a school study French and Spanish.  
 The probability that a student is good at French is 0.8  
 If a student is good at French, then the probability that he/she is good at Spanish is 0.9  
 If a student is **not** good at French, then the probability that he/she is good at Spanish is 0.3

- (a) Complete the tree diagram to show the probabilities when a student is selected at random.



(4 marks)

- (b) Calculate the probability that a student selected at random is good at French **and** Spanish.

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Answer ..... (2 marks)

- (c) Calculate the probability that a student selected at random is good at Spanish.

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Answer ..... (3 marks)

- (d) 390 students are good at Spanish.  
How many of these students would you also expect to be good at French?

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Answer ..... (4 marks)

- 3 A youth club has 72 members.  
The leader decides to select six members at random to go on a sailing course.  
He numbers the members 01 to 72 and uses the random number table below to make his selection.

29	44	76	56
44	51	38	00
07	21	92	17

- (a) Starting with 29 and reading across each row, write down the number of each of the six members that he selects.

Answer ..... (3 marks)

- (b) The youth club has 48 boys and 24 girls as members.

Calculate the number of boys and girls the leader should include in a stratified sample of six members.

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Boys .....

Girls .....

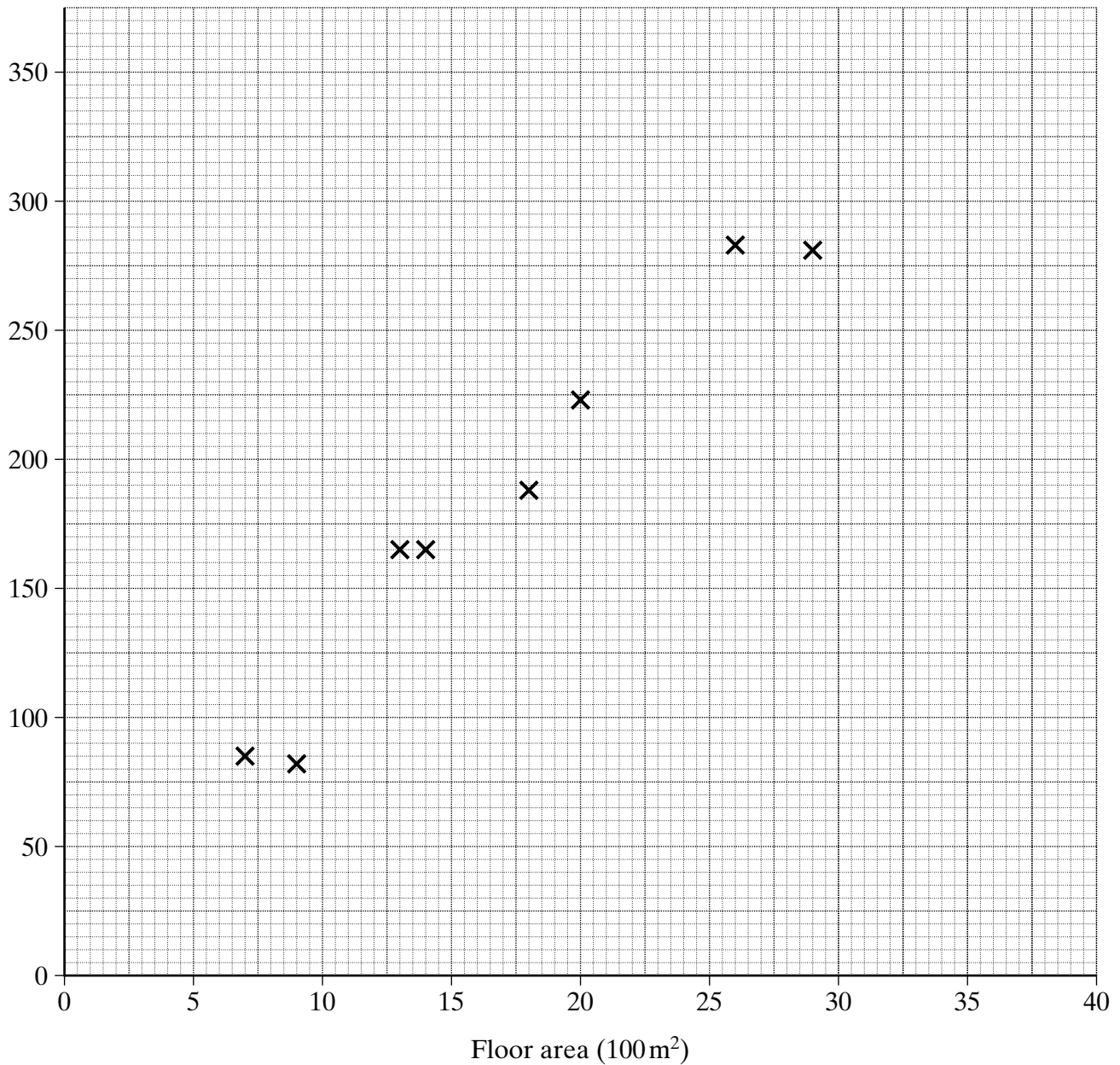
(3 marks)

4 The scatter diagram shows the floor area ( $100 \text{ m}^2$ ) and the daily takings (£1000) for a chain of supermarkets.

- (a) The mean floor area is  $1700 \text{ m}^2$   
The mean daily takings are £184 000

Draw a line of best fit on the scatter diagram.

Daily takings (£1000)



(2 marks)

(b) It is proposed to build two new supermarkets.

Use your line of best fit to estimate the daily takings for a supermarket with floor area

(i) 2200 m<sup>2</sup>

Answer £ ..... (1 mark)

(ii) 3500 m<sup>2</sup>

Answer £ ..... (1 mark)

(c) Which of these estimates is more reliable?  
Give a reason for your answer.

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.....  
(1 mark)

(d) What is the expected increase in daily takings for each additional 100 m<sup>2</sup> of floor area?

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.....  
Answer £ ..... (2 marks)

(e) The equation of the line of best fit for a chain of DIY stores passes through the points (6,25) and (20,250).

Draw this line on the scatter diagram. (1 mark)

(f) Compare the daily takings of the chain of supermarkets and the chain of DIY stores.

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(1 mark)

**QUESTION 4 CONTINUES ON THE NEXT PAGE**

(g) The floor areas and the daily takings of the supermarkets are given in the table.

Supermarket	A	B	C	D	E	F	G	H
Floor area (100 m <sup>2</sup> )	7	9	13	14	18	20	26	29
Daily takings (£1000)	85	82	165	165	188	223	283	281

(i) Calculate the value of Spearman's rank correlation coefficient.

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Answer ..... (6 marks)

(ii) Interpret, in context, the value of Spearman's rank correlation coefficient.

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(1 mark)

(h) Write down the least and greatest daily takings of supermarket **F** that will **not** change the value of Spearman's rank correlation coefficient.

Least value £ .....

Greatest value £ .....

(2 marks)



**TURN OVER FOR THE NEXT QUESTION**

**Turn over** ►

5 Louise collects CDs.  
She keeps records of her CDs.  
The records she keeps are

- the cost
- the length of time each track lasts
- the number of tracks on each CD.

(a) Give an example of

(i) a discrete variable that Louise records

Answer ..... (1 mark)

(ii) a continuous variable that Louise records.

Answer ..... (1 mark)

(b) The length of time,  $t$  (seconds) of her favourite tracks is given in the table.

Time, $t$ (seconds)	Frequency
$120 \leq t < 150$	12
$150 \leq t < 180$	17
$180 \leq t < 210$	21
$210 \leq t < 240$	8
$240 \leq t < 270$	2

Calculate estimates of the mean and standard deviation of these times.

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Mean ..... seconds

Standard deviation ..... seconds  
(4 marks)

- (c) David wishes to calculate an estimate of the mean time of his favourite tracks. He uses the same time intervals as Louise. He codes the data using 135 seconds as 0, 165 seconds as 1, 195 seconds as 2 and so on. David calculates the mean of the coded data as 3.6

Calculate the estimate of the mean time of David's favourite tracks.

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Answer ..... seconds (3 marks)

**TURN OVER FOR THE NEXT QUESTION**

6	A bag contains	7	1p coins
		6	2p coins
		4	5p coins
		3	10p coins

- (a) One coin is selected at random.

What is the probability that it is worth more than 4 pence?

Answer ..... (1 mark)

- (b) The coin is replaced.  
A second coin is selected at random.  
It is worth more than 4 pence.

What is the probability that it is a 10p coin?

Answer ..... (2 marks)

7 The table shows the cost indices for renting a shop, using 1997 as the base year.

<b>Year</b>	1997	1998	1999	2000	2001	2002
<b>Cost Index</b>	100	115	96	118	110	113

(a) In which years did the rent fall?

Answer ..... (2 marks)

(b) The annual rent was £6900 in 1998.

(i) Calculate the annual rent in 1997.

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Answer £ ..... (2 marks)

(ii) Calculate the annual rent in 2002.

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Answer £ ..... (2 marks)

(c) In which year was the annual rent the highest?

Answer ..... (1 mark)

(d) Calculate the percentage increase in the annual rent between 2001 and 2002.

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Answer ..... % (3 marks)

8 The number of weddings, in thousands, for 14 consecutive quarters are given in the table. Some of the four-point moving averages have been calculated.

Year	Quarter	Number of Weddings (thousands)	Four-point Moving Average (1 d.p.)
1996	1	41.0	
1996	2	91.4	
1996	3	129.4	79.4
1996	4	55.8	79.0
1997	1	39.3	77.9
1997	2	87.1	77.8
1997	3	128.9	77.6
1997	4	54.9	77.2
1998	1	37.7	76.8
1998	2	85.6	75.9
1998	3	125.5	76.2
1998	4	56.0	
1999	1	36.9	
1999	2	83.2	

(a) Calculate the value of the next **two** four-point moving averages and put them in the table.

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(3 marks)

(b) The original data is plotted on the grid opposite.

Plot all the four-point moving averages on the same grid.

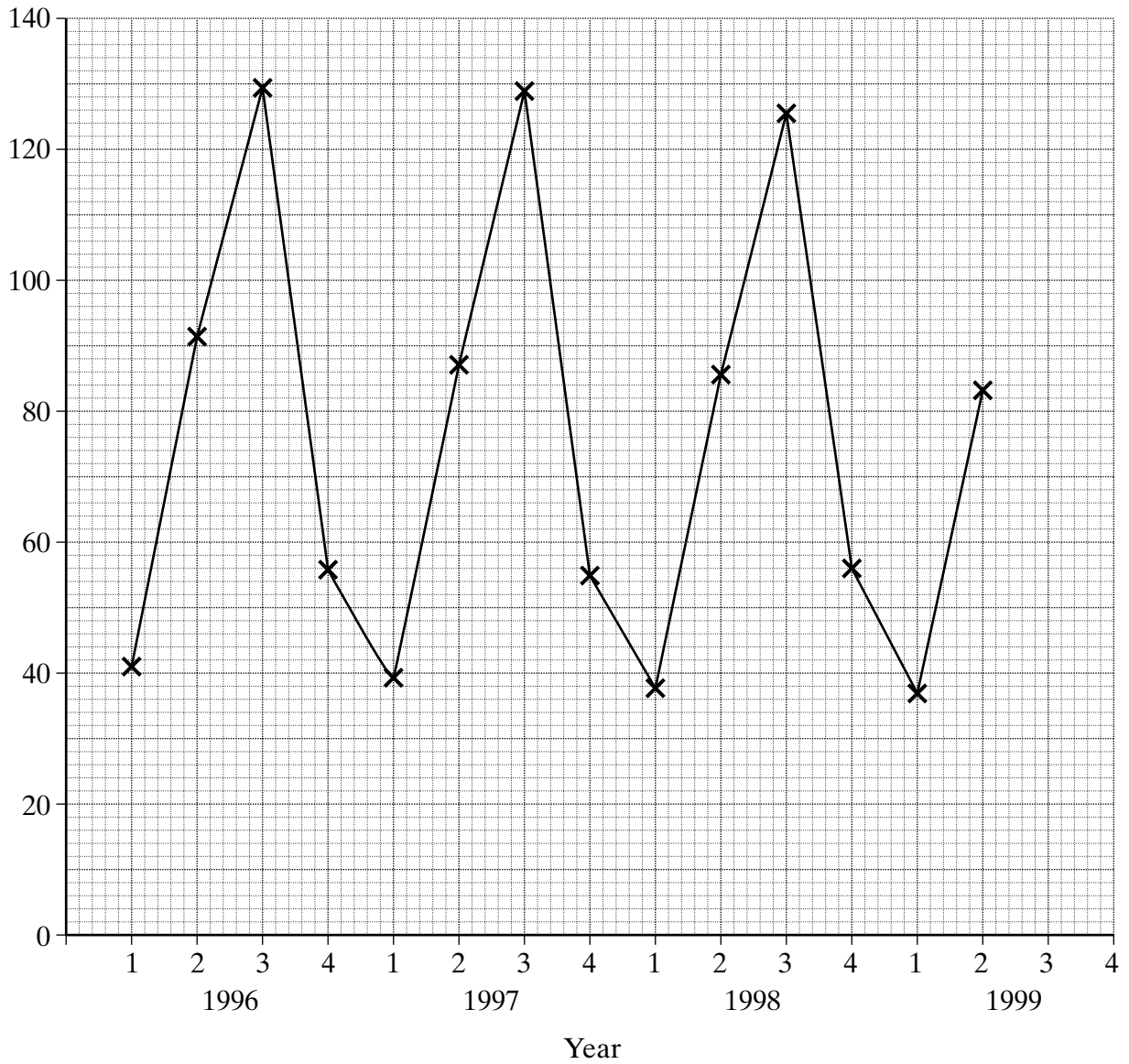
(2 marks)

(c) The seasonal variations for quarter 3 are 52 000, 52 000 and 49 000.

Use this information together with a trend line to obtain an estimate for the number of weddings in quarter 3 of 1999.

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Answer ..... (4 marks)

Number of weddings  
(thousands)

9 In a questionnaire, Niles was finding out about pupils' taste in music.

(a) Why might he carry out a pilot survey first?

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(1 mark)

(b) Explain how he could obtain a systematic sample.

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(2 marks)

(c) He decides to use a quota sample.

Explain how he could obtain a quota sample.

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(2 marks)

(d) Give **one** advantage of using a systematic sample over a quota sample.

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(1 mark)

(e) Give **one** advantage of using a quota sample over a systematic sample.

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(1 mark)



**10** A group of scientists wants to estimate the number of fish in a lake.  
They catch and ring 100 fish.  
They return the 100 fish to the lake.  
They then catch 300 fish.  
Of these 300 fish, 14 are ringed.

(a) Estimate the number of fish in the lake.

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Answer ..... (3 marks)

(b) What could the scientists do to improve the accuracy of their estimate?

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(1 mark)

**TURN OVER FOR THE NEXT QUESTION**

- 11** The table gives the population distribution, by age, in Yoxton and the number of unemployed for each age group.  
The table also gives the standard population for the region containing Yoxton.

<b>Age</b>	<b>Population of Yoxton (1000's)</b>	<b>Number unemployed</b>	<b>Standard population</b>
16 to 19	1.9	158	7 %
20 to 24	4.3	230	11 %
25 to 49	13.1	662	56 %
50 and over	9.5	277	26 %
<b>Total</b>	28.8	1327	100 %

- (a) Calculate the crude unemployment rate for Yoxton.

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Answer ..... (2 marks)

- (b) Calculate the standardised unemployment rate for Yoxton.

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Answer ..... (5 marks)

**TURN OVER FOR THE NEXT QUESTION**



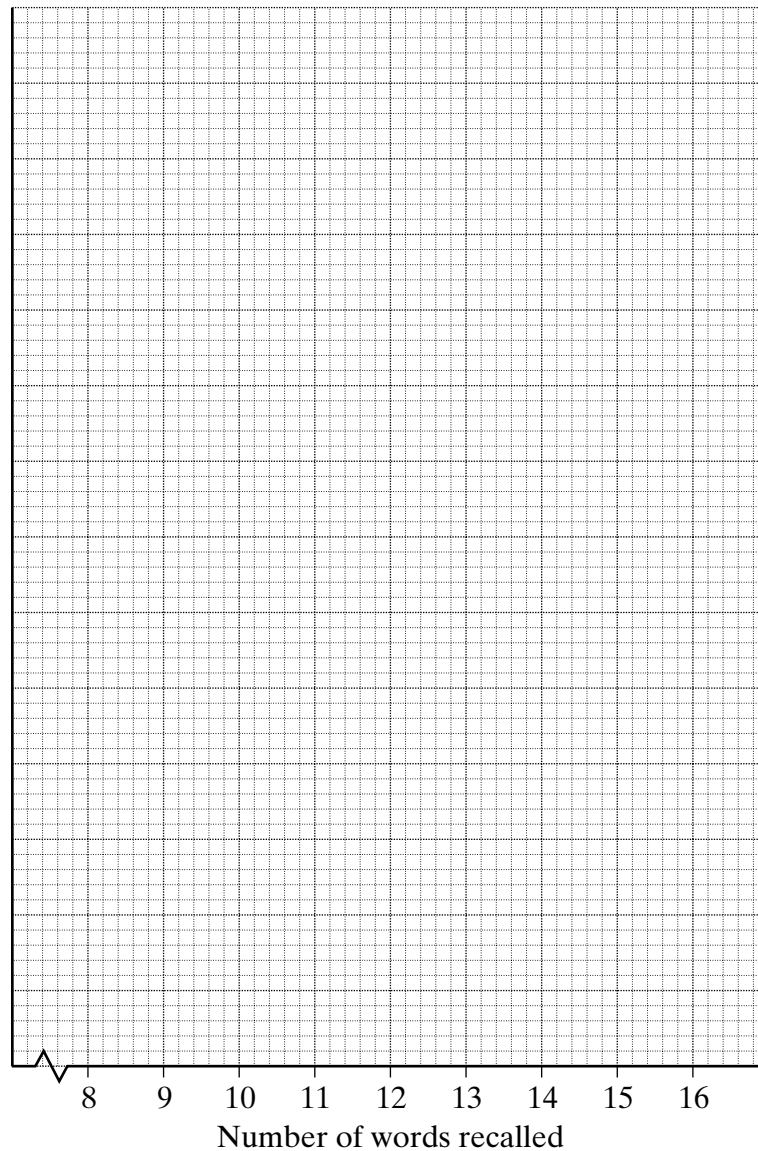
**Turn over** ►

- 12** 120 boys were given a memory test. They were presented with 20 random words and given a short time to memorise them. They then had to write down as many words as they could remember. The table gives the number of boys that recalled the given number of words.

Number of words recalled	Number of boys
8	3
9	0
10	8
11	18
12	22
13	27
14	18
15	18
16	6

- (a) Draw a cumulative frequency step polygon.

Cumulative frequency



(4 marks)

- (b) Find the median, the second and eighth deciles and calculate the interdecile range between these two deciles.

Median .....

Second decile .....

Eighth decile .....

Interdecile range .....

(4 marks)

- (c) 120 girls were also given the same memory test. Their results are summarised as

Median                    12

Second decile         10

Eighth decile         16

Compare the memory test results of the boys and girls.

Comparison 1

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Comparison 2

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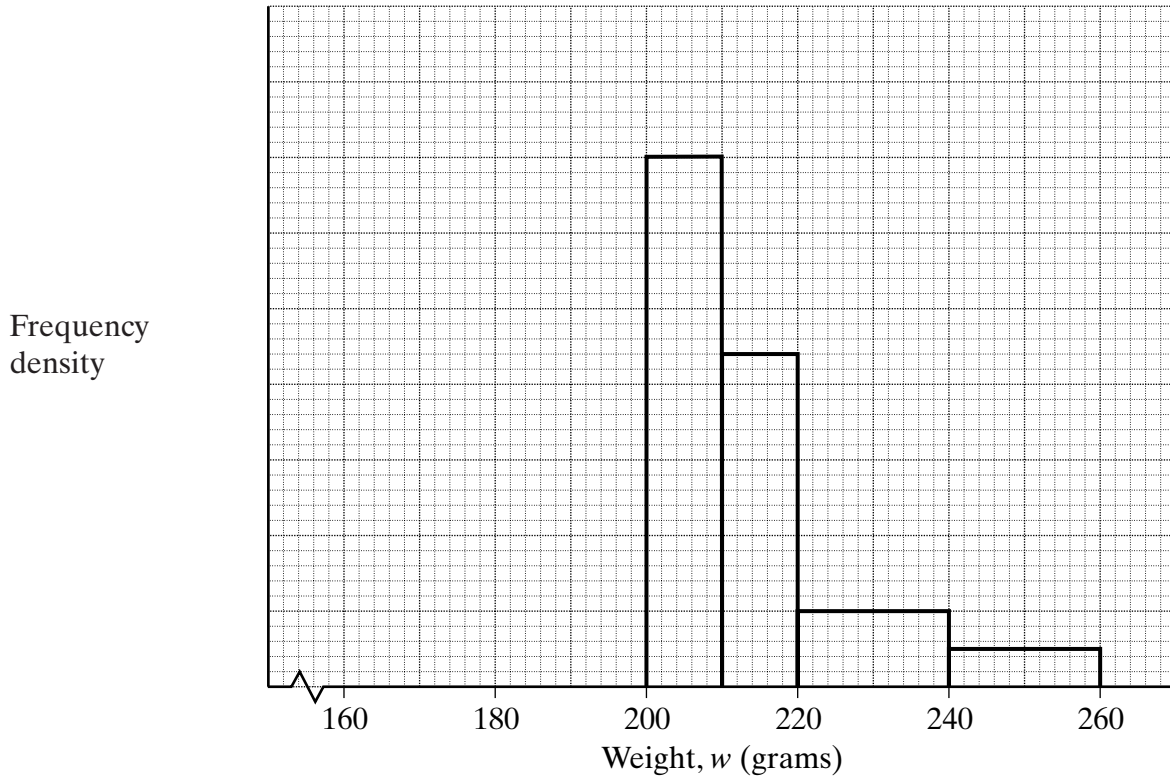
(2 marks)

**TURN OVER FOR THE NEXT QUESTION**

13 The weights,  $w$  (grams), of 125 grapefruit are summarised in the table.

Weight, $w$ (grams)	Frequency
$160 \leq w < 180$	8
$180 \leq w < 190$	15
$190 \leq w < 200$	30
$200 \leq w < 210$	35
$210 \leq w < 220$	X
$220 \leq w < 240$	Y
$240 \leq w < 260$	Z

Part of a histogram is drawn to represent this data.



(a) Scale the frequency density axis. (1 mark)

(b) Calculate the value of

(i) X

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.....

Answer .....

(2 marks)

(ii) Y

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Answer ..... (1 mark)

(iii) Z.

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Answer ..... (1 mark)

(c) Complete the histogram. (3 marks)

(d) Calculate an estimate of the median weight.

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Answer ..... grams (4 marks)

**TURN OVER FOR THE NEXT QUESTION**

Turn over 

- 14** Two machines produce equal numbers of cartons of juice. Cartons are filled with apple juice by one machine and with blackcurrant juice by the other machine. The distributions of the volumes of juice are both normal. The mean and standard deviation of each distribution are shown in the table.

	Mean (ml)	Standard deviation (ml)
Apple juice	100	10
Blackcurrant juice	110	2

- (a) A carton is selected at random and contains at least 114 ml of juice.

Is it more likely to contain apple juice or blackcurrant juice?

You must support your answer with calculations.

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Answer ..... (4 marks)

- (b) The two machines are equally likely to produce cartons that contain less than a certain volume of juice.

What is this volume?

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Answer ..... ml (4 marks)

**END OF QUESTIONS**