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General Certificate of Secondary Education  
June 2004



**STATISTICS**  
**Higher Tier**

3311/H

Friday 25 June 2004 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 – 25	
26 – 27	
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 The number of pupils in each unit area of a playground is shown below.

2	3	4	8	9	7	8	4
3	4	8	10	12	14	10	7
3	7	9	8	13	15	12	8
0	1	4	7	8	10	6	3
0	0	3	2	4	2	1	0

(a) Complete the choropleth map using the given key.

<b>Number of pupils</b>	
0 - 5	
6 - 10	
11 - 15	


(2 marks)

(b) There is a teacher in the playground.  
Where do you think the teacher is?

Explain your answer.

.....

.....

(1 mark)

2 Five cards numbered 1 to 5 are shown.

1

2

3

4

5

Two cards are drawn at random without replacement.

The numbers on the two cards are added.

Find the probability that the total of the two numbers is 5.

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.....

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Answer ..... (4 marks)

3 The table below shows the prices of two items in 1990 and 2001.

Item	Price (pence)		Price index for 2001 relative to 1990
	1990	2001	
Milk (litre)	40	55	P
Butter (per pack)	64	Q	125

(a) Show that the value of P is 137.5

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*(2 marks)*

(b) Calculate the value of Q.

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Answer ..... *(3 marks)*

**TURN OVER FOR THE NEXT QUESTION**

4 A survey of the eating habits of pupils at a school is to be carried out.

(a) Give **one** reason why it might be useful to undertake a pilot survey.

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*(1 mark)*

(b) Give **one** reason why each of the following methods would **not** give random results.

(i) Standing outside the school canteen on a Monday lunchtime questioning pupils as they arrive.

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*(1 mark)*

(ii) Sending a questionnaire to every pupil on the school register whose surname begins with S.

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*(1 mark)*

(c) Describe a method of choosing a random sample of pupils from the school.

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*(2 marks)*

(d) The school canteen keeps a daily record of its customers.

State whether each of the following variables is qualitative, discrete or continuous.

(i) The number of pupils served.

Answer ..... (1 mark)

(ii) The age of the pupils served.

Answer ..... (1 mark)

(e) The canteen asks its customers to complete an opinion scale about the quality of service.

Explain why a customer may prefer a five-point scale to a four-point or six-point scale.

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(1 mark)

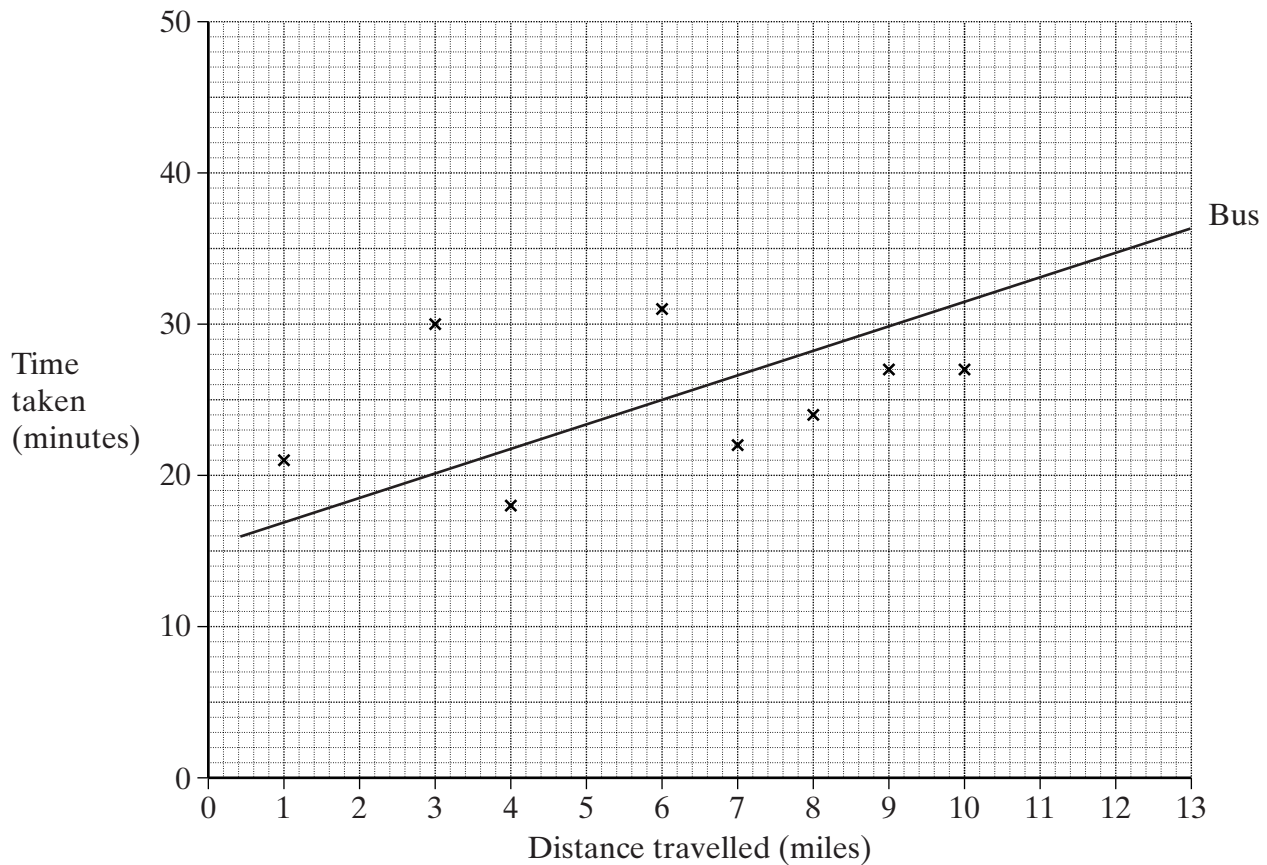
**TURN OVER FOR THE NEXT QUESTION**

Turn over ►

5 Sixteen different journeys made through a city centre were timed.

Eight of the journeys were by bus.

The distance travelled and time taken for the bus journeys have been plotted on the scatter diagram below and the line of best fit has been drawn.



The other eight journeys were by car.

The distance travelled and time taken for the car journeys are shown in the table.

<b>Distance travelled (miles)</b>	6	7	2	10	5	9	1	8
<b>Time taken (minutes)</b>	18	23	11	36	18	31	7	32



(a) Plot the car journey values on the scatter diagram. (2 marks)

(b) The mean distance travelled by car was 6 miles.  
Calculate the mean time taken for the car journeys.

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Answer ..... minutes (2 marks)

(c) Draw a line of best fit for the car journeys on the scatter diagram. (2 marks)

(d) Estimate the time taken for

(i) a 12 mile car journey,

Answer ..... minutes (1 mark)

(ii) a 2 mile bus journey.

Answer ..... minutes (1 mark)

(e) Which of these estimates is likely to be more reliable?  
Give a reason for your answer.

More reliable .....

Reason .....

.....  
.....

(2 marks)

(f) Use the graph to find the shortest distance at which it becomes quicker to travel by bus rather than car.  
Give a reason for your answer.

Shortest distance .....

Reason .....

.....

(2 marks)

**QUESTION 5 CONTINUES ON THE NEXT PAGE**

Turn over ►

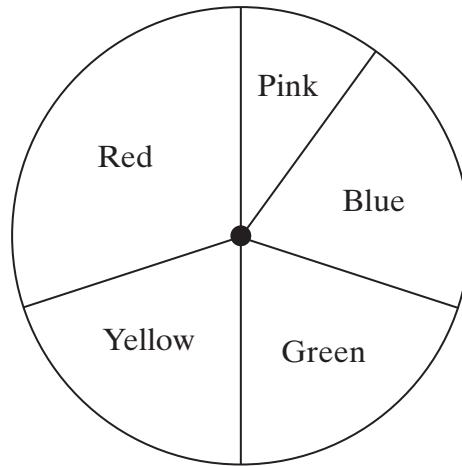


**TURN OVER FOR THE NEXT QUESTION**

$\frac{8}{8}$

**Turn over** 

6 A spinner has five coloured sections as shown.



(a) In a simulation

- 0 represents Pink (P)
- 1 and 2 represent Blue (B)
- 3 and 4 represent Green (G)
- 5 and 6 represent Yellow (Y)
- 7, 8 and 9 represent Red (R)

Use the random numbers below to complete a simulation of twenty spins.

4	3	8	2	7	2	6	8	9	3	2	1	5	0	0	8	5	2	2	6
G	G	R																	

(2 marks)

(b) Use this simulation to estimate

(i) the probability of Red,

.....

Answer ..... (1 mark)

(ii) the expected number of Reds in 100 spins.

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Answer ..... (2 marks)

- (c) Explain how you would expect the probability of Red in part (b)(i) to change if the simulation is carried out 1000 times.

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*(2 marks)*

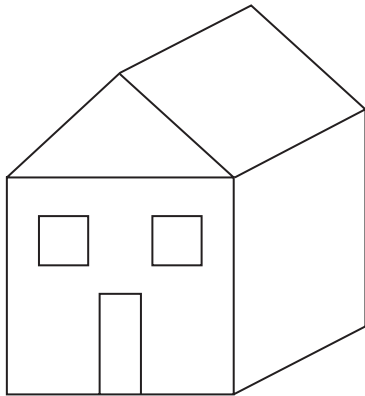
**TURN OVER FOR THE NEXT QUESTION**



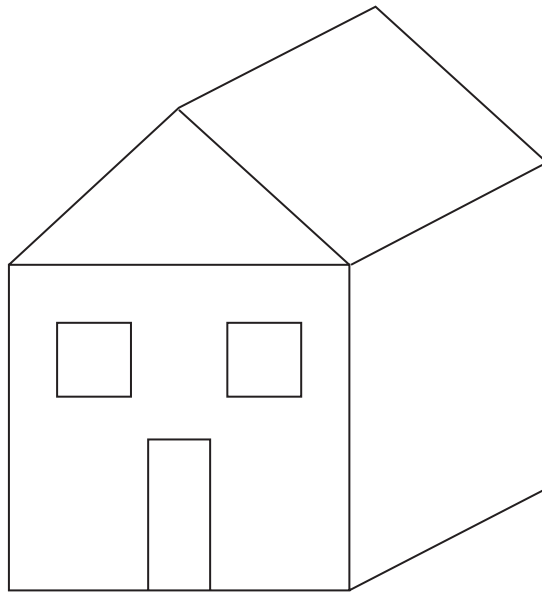
**Turn over** ►

7 An estate agent has one house for sale at £100 000 and one at £150 000.

The diagram has been drawn to represent this information.



Price £100 000



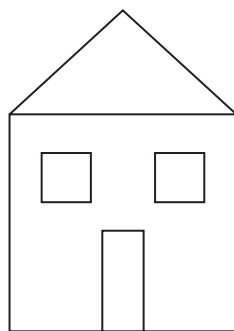
Price £150 000

(a) Explain why the diagram is misleading in representing these house prices.

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(1 mark)

(b) The agent decides to represent the houses using a two dimensional diagram.



The width representing the £100 000 house is 3 cm.  
Calculate the width representing the £150 000 house.

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Answer ..... cm (3 marks)

(c) The table gives the price index for three years for the cost of a flat.

Price index for 2002 relative to 2001	105
Price index for 2003 relative to 2002	140
Price index for 2004 relative to 2003	130

Calculate the geometric mean of these three price indices.

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Answer ..... (2 marks)

(d) Write down the average annual rate of increase of the price of the flat over the three years.

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Answer ..... % (1 mark)

**TURN OVER FOR THE NEXT QUESTION**



Turn over

8 The length of reign of each of the last 19 monarchs is given in the table.

George VI	16 years	George IV	10 years	James II	3 years
Edward VIII	0 years	George III	60 years	Charles II	25 years
George V	26 years	George II	33 years	Charles I	24 years
Edward VII	9 years	George I	13 years	James I	22 years
Victoria	64 years	Anne	12 years	Elizabeth I	45 years
William IV	7 years	William III	14 years	Mary	5 years
				Edward VI	6 years

(a) Represent the data in an ordered stem and leaf diagram.

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(4 marks)

(b) Find the median and quartiles of the length of reign of these 19 monarchs.

Median ..... years

Lower quartile ..... years

Upper quartile ..... years

(3 marks)



- (c) Write down the name of any monarch whose length of reign is an outlier. You **must** show calculations to support your answer.

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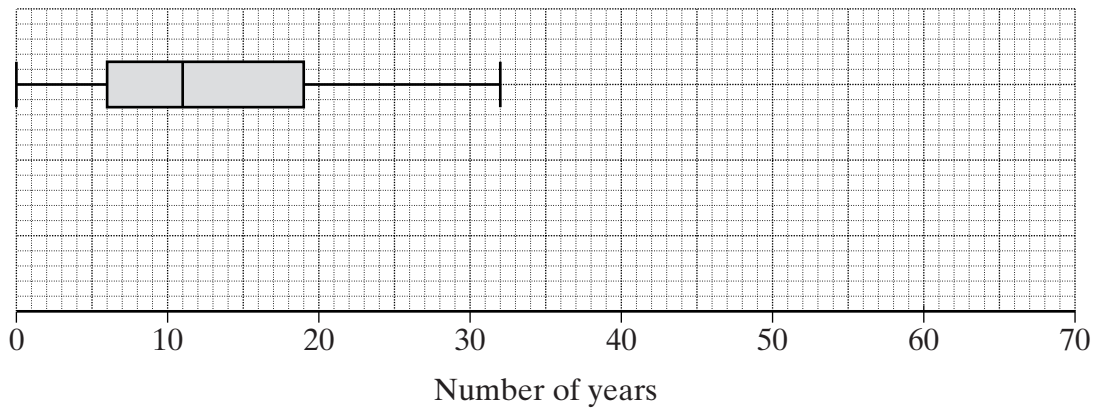
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Answer ..... (3 marks)

- (d) The box and whisker plot shows the length of reign of the last 19 popes.



Draw a box and whisker plot for the length of reign of the last 19 monarchs on the same diagram.

(4 marks)

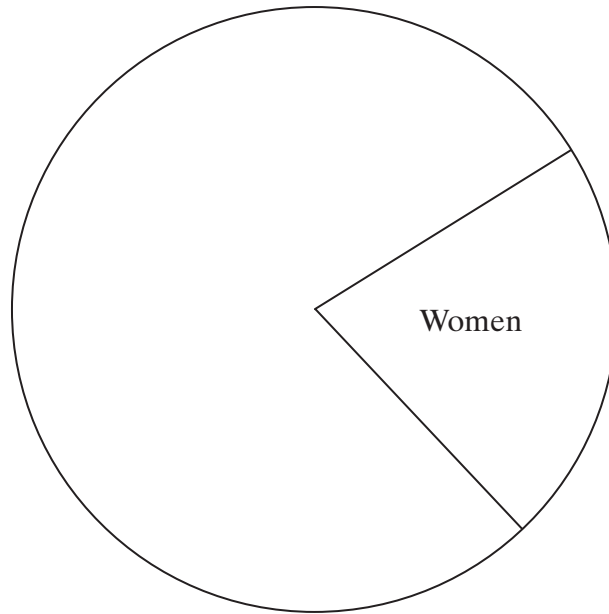
- (e) Compare the length of reign of monarchs and popes.

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(2 marks)

9 The pie chart shows the number of people attending a league football match.



The total number of people attending the match was 15 110.

The sector representing the number of women attending the match is labelled.

The angle of this sector is 78.6 degrees.

(a) Calculate the number of women attending the match.

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Answer ..... (2 marks)

(b) The number of men at the match was 8275 and the remainder were children.

Complete the pie chart.

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(4 marks)

(c) The radius of the pie chart opposite is 4 cm.

The radius of a comparative pie chart for an international football match is 8.2 cm.

Calculate the number attending the international football match.

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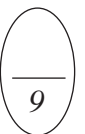
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Answer ..... (3 marks)

**TURN OVER FOR THE NEXT QUESTION**

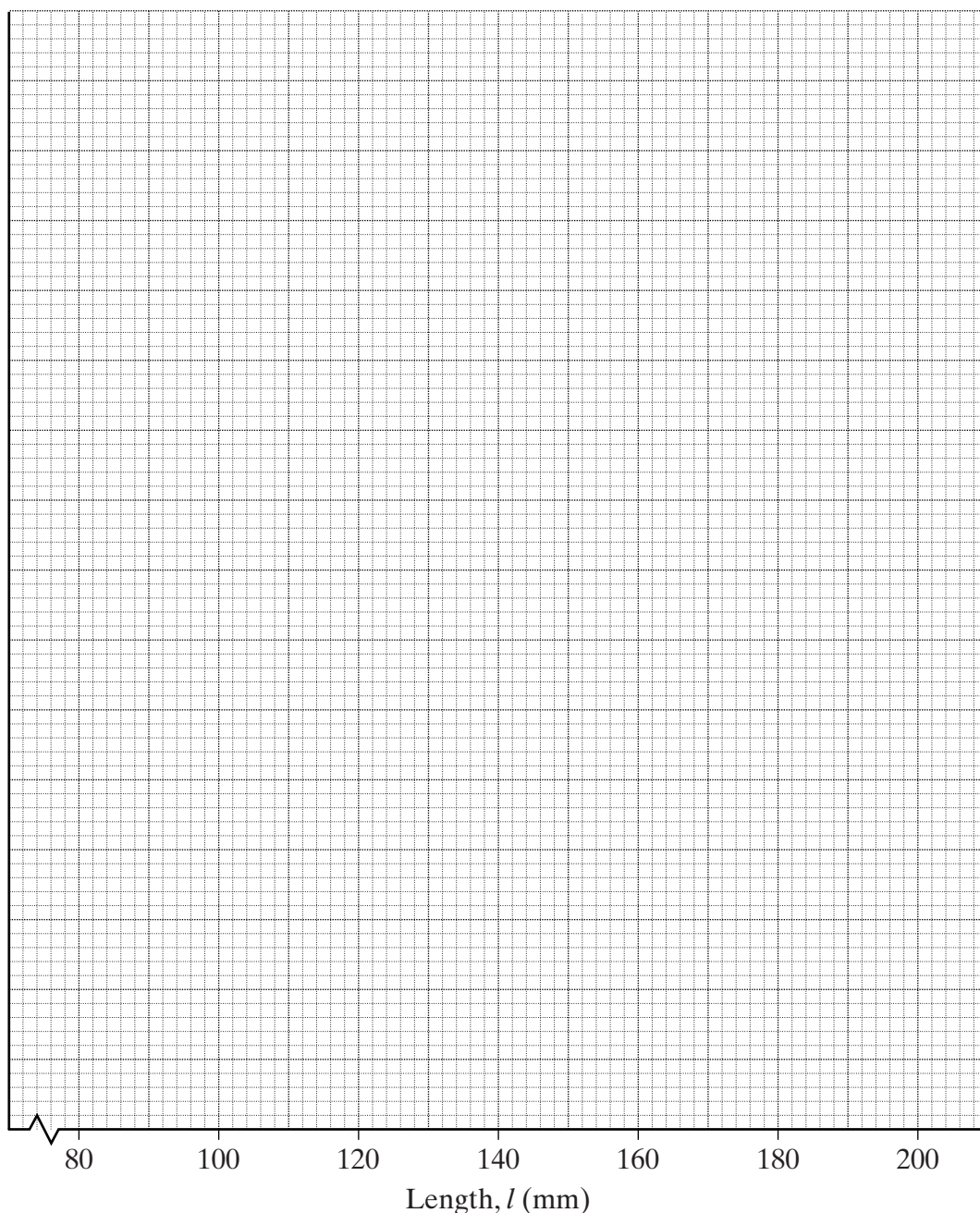


**Turn over** ▶

- 10 The frequency table gives the length, in mm, of 150 leaves.  
The shortest leaf is 80 mm long. The longest leaf is 195 mm long.

Length, $l$ (mm)	Frequency
$l < 100$	6
$100 \leq l < 120$	16
$120 \leq l < 130$	27
$130 \leq l < 135$	20
$135 \leq l < 140$	17
$140 \leq l < 150$	32
$150 \leq l < 160$	16
$160 \leq l < 180$	12
$180 \leq l$	4

- (a) Draw a cumulative frequency polygon to illustrate these data.



(4 marks)

- (b) Use your graph to obtain an estimate for the interpercentile range between the 10<sup>th</sup> and 90<sup>th</sup> percentiles.

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Answer ..... mm (4 marks)

- (c) What is the advantage of using the interpercentile range between these percentiles instead of the range?

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(1 mark)

**TURN OVER FOR THE NEXT QUESTION**

Turn over ►

- 11 The mean and standard deviation of the marks in a Mathematics exam and in a Statistics exam are shown.

	Mean	Standard deviation
Mathematics	63	6
Statistics	73	8

The marks in both exams are normally distributed.

- (a) John scored 54 marks in the Mathematics exam and 57 marks in the Statistics exam.

John claimed that he was better at Mathematics.

By standardising his marks decide if the data supports his claim.

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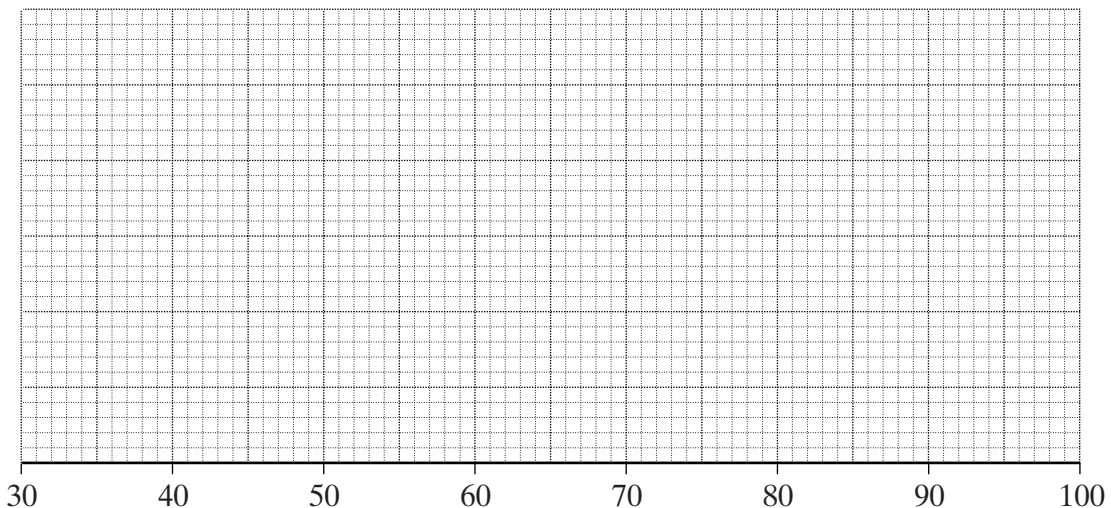
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(5 marks)

- (b) Sketch the distributions for both Mathematics and Statistics.



(4 marks)

**TURN OVER FOR THE NEXT QUESTION**

$\frac{\quad}{9}$

**Turn over** 

12 Ten pupils took an exam.

The sum of their marks was 315.

The sum of the squares of their marks was 10829.

(a) Calculate the mean and standard deviation for these ten exam marks.

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Mean .....

Standard deviation .....

*(4 marks)*

(b) One of the marks was 32 but was incorrectly recorded as 23.

Calculate the correct mean and standard deviation.

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Mean .....

Standard deviation .....

*(6 marks)*



(c) Explain

(i) why the mean has increased,

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*(1 mark)*

(ii) why the standard deviation has decreased.

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*(1 mark)*

**TURN OVER FOR THE NEXT QUESTION**

12

**Turn over** ▶

- 13 In the game of paper, scissors and stone, Chris and Steve place a hand behind their backs. They display their hands, at the same time, as one of the three symbols shown.



Paper



Scissors



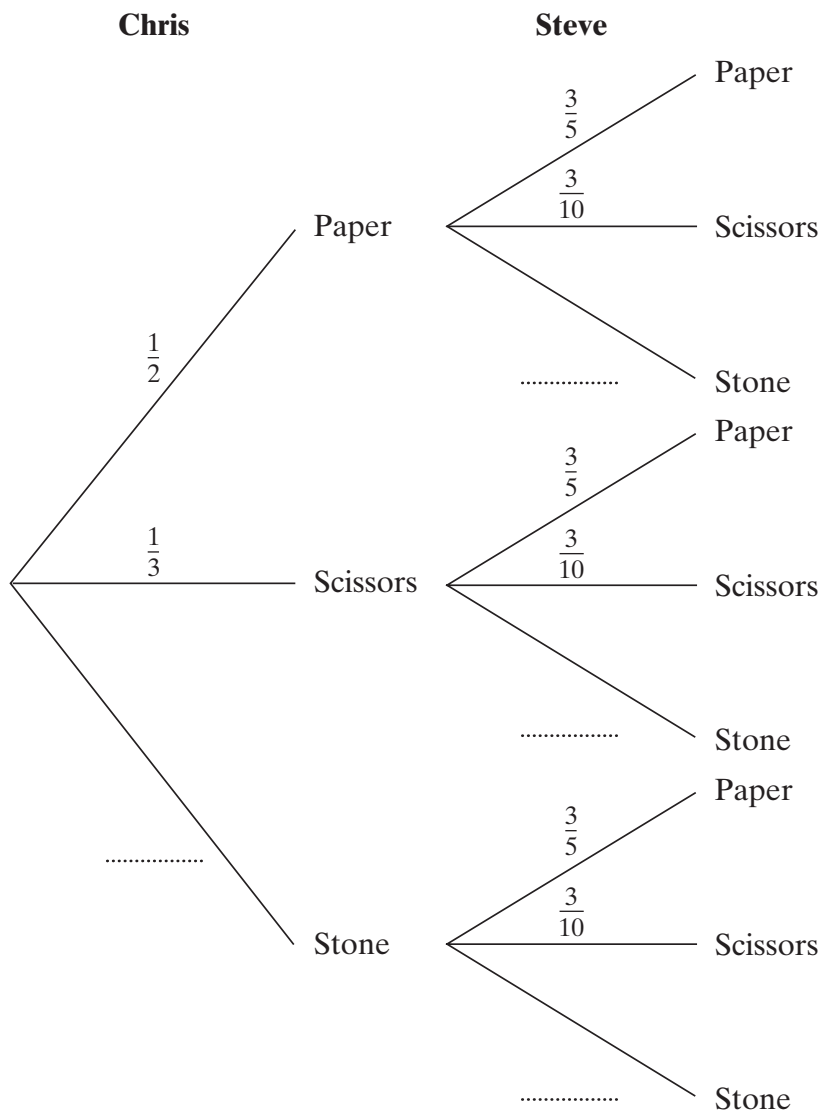
Stone

Their choices of symbol are independent.

Chris selects paper with a probability of  $\frac{1}{2}$  and scissors with a probability of  $\frac{1}{3}$ .

Steve selects paper with a probability of  $\frac{3}{5}$  and scissors with a probability of  $\frac{3}{10}$ .

- (a) Complete the tree diagram.



(2 marks)

(b) A game is played between Chris and Steve.

Paper beats stone (by wrapping it).

Scissors beat paper (by cutting it).

Stone beats scissors (by blunting them).

The game is a draw if both players display the same symbol.

(i) Show that the probability of a draw is  $\frac{5}{12}$ .

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(3 marks)

(ii) Calculate the probability that Chris wins.

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Answer ..... (3 marks)

(c) Three games are played.

Calculate the probability that exactly one game is drawn.

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Answer ..... (3 marks)

**END OF QUESTIONS**

**THERE ARE NO QUESTIONS PRINTED ON THIS PAGE**