

Surname					Other Names				
Centre Number					Candidate Number				
Candidate Signature									

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General Certificate of Secondary Education
June 2003



STATISTICS
Higher Tier

3311/H

Friday 20 June 2003 9.00 am to 11.30 am

H

<p>In addition to this paper you will require:</p> <ul style="list-style-type: none"> • a calculator • mathematical instruments. 	
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For Examiner's Use	
Pages	Mark
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.

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 Expectation of life is the further number of years which a person of a certain age and gender may expect to live.

The table gives this information for United Kingdom residents in the years 1931 and 1991.

The table, adapted from 'Social Trends' (2002), is not reproduced here due to third-party copyright constraints.

□

The full copy of this paper can be obtained by ordering 3311/H from AQA Publications □
Tel: 0161 953 1170 □

For example, in 1931 a man aged 30 could expect to live another 38 years.

- (a) (i) Write down how many years a woman aged 30 in 1931 could expect to live.

Answer (1 mark)

- (ii) Compare the data for men with that for women.

What conclusion can you draw?

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(1 mark)

- (b) The expectation of life of both men and women in 1991 is longer than in 1931. Give a possible reason for this.

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(1 mark)

(c) (i) Comment on the life expectancy in 1931 of children at birth and at 1 year old.

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(1 mark)

(ii) Give a possible reason for this.

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(1 mark)

TURN OVER FOR THE NEXT QUESTION

Turn over ▶



2 In May 2001 an estate agent sold nine, three-bedroomed houses.
The sale prices in pounds were:

59 200	65 000	52 000
129 500	52 000	62 500
54 500	57 900	56 000

(a) Write down the mode of these prices.

Answer £ (1 mark)

(b) (i) Calculate the mean of these prices.

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Answer £ (2 marks)

(ii) Give a **disadvantage** in using the mean to represent these prices.

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.....

(1 mark)

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

(i) The time taken for the estate agent to sell one of these three-bedroomed houses

Answer (1 mark)

(ii) The sale price of a three-bedroomed house

Answer (1 mark)

(iii) The gender of the estate agent

Answer (1 mark)

(d) The estate agent receives 400 enquiries for a particular house.
He decides to take a simple random sample of 10% of this group to find out how many have a house to sell.

(i) Describe how this sampling method could be carried out.

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(3 marks)

(ii) Give **two** reasons why he should **not** base his sample on the first 40 people who rang his office to enquire about the house on Monday morning after 10 am.

Reason 1

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Reason 2

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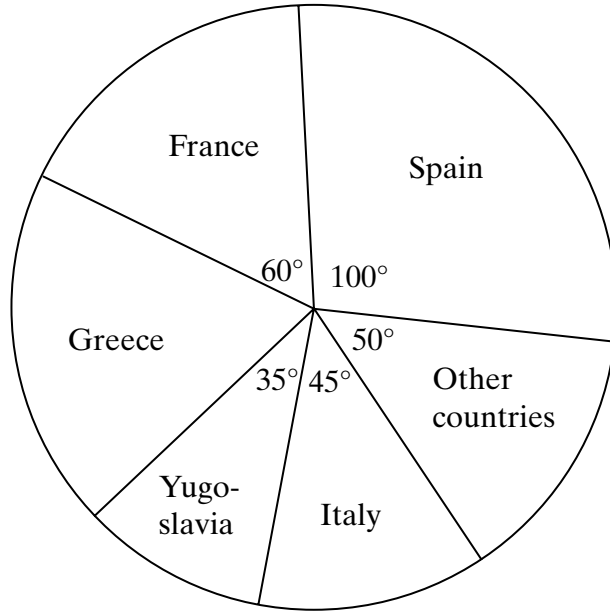
(2 marks)

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

3 A travel agent kept a record of the destinations of those customers who travelled abroad in 1998.

This information is illustrated in the pie chart below. Angles shown are given to the nearest degree.



(a) Calculate the percentage of these customers who travelled to Yugoslavia.

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Answer % (2 marks)

(b) 468 of their customers travelled abroad.
 Calculate the number of their customers who travelled to Greece.

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Answer (3 marks)

- (c) The following year the travel agent reported that 825 people went abroad.
The radius of the pie chart for 1998 is 4 cm.
Calculate the radius of the comparative pie chart for 1999.

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Answer cm (3 marks)

TURN OVER FOR THE NEXT QUESTION

Turn over 



4 The table gives the number of pairs of shoes sold by size and width fitting by a local shop.

		Width fitting				Total
		C	D	E	F	
Shoe size	5	3	5	3	2	13
	6	4	7	8	3	22
	7	2	4	5	3	14
	8	1	2	3	1	7
Total		10	18	19	9	56

(a) What is the probability that a person selected at random buys a pair of shoes of size 5, width D?

Answer (1 mark)

(b) What is the probability that a person selected at random buys a pair of size 5 shoes?

Answer (1 mark)

(c) What is the probability that a person selected at random buys shoes of width D, given that they bought shoes of size 5?

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Answer (2 marks)

(d) Two people are selected at random.

What is the probability that they both bought shoes of size 5?

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Answer (3 marks)

TURN OVER FOR THE NEXT QUESTION

Turn over 



5 Fifteen teams took part in a quiz.
Their scores are as follows:

81	64	75	70	68
78	74	69	76	72
62	82	53	75	69

(a) Draw an ordered stem and leaf diagram to illustrate these data.

Key : 8 | 1 means 81 (3 marks)

(b) Find the median and quartiles of the scores.

Median

Lower quartile

Upper quartile
(3 marks)

(c) (i) Find the interquartile range.

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Answer (1 mark)

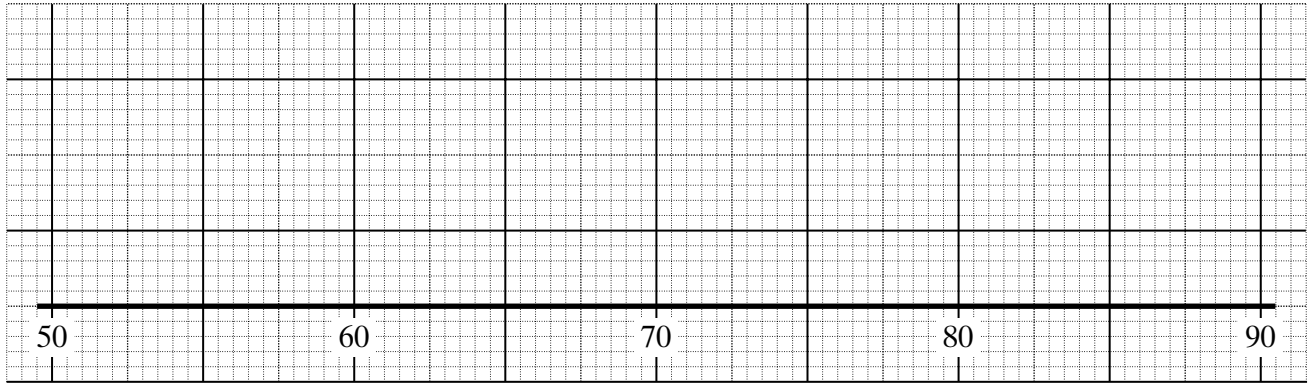
(ii) Explain why 53 is an outlier.

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(2 marks)

(d) Draw a box and whisker plot to illustrate these data.



Scores (4 marks)

(e) The top eight teams took part in a second quiz.
The first and second quiz scores for each of these teams are given below.

First quiz	81	75	78	74	76	72	82	75
Second quiz	70	73	60	68	65	74	76	67

(i) Calculate the value of Spearman's rank correlation coefficient.
Give your answer to 3 decimal places.

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Answer (6 marks)

(ii) What does your answer to part (e)(i) suggest about the performance of these eight teams in the two quizzes?

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(1 mark)
Turn over ▶

6 A firm produces tins of baked beans. For quality control purposes, a sample of five tins of baked beans is taken every hour and the mass of each tin is measured.

The mean mass and range of masses of each sample is calculated and plotted on separate graphs.

The graphs below show the mean mass and range of masses of the first seven samples.

The eighth sample has tins of baked beans of the following masses:

1.072 kg 0.998 kg 1.024 kg 1.037 kg 1.046 kg

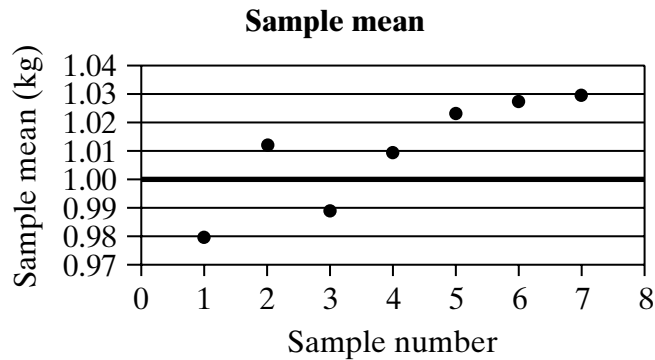
The mean mass of this sample is 1.0354 kg.

(a) Calculate the range of masses of this sample.

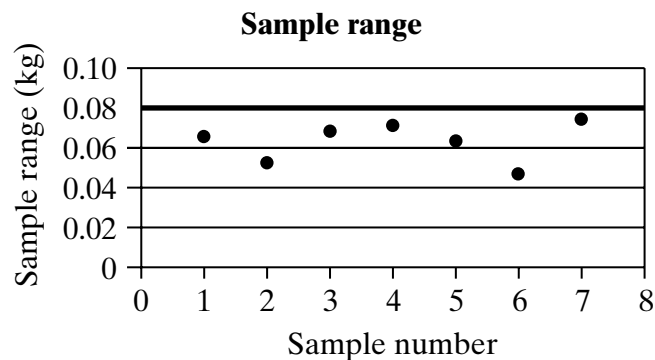
Answer kg (1 mark)

(b) Plot the values of the eighth sample on the appropriate graphs.

The target mean is 1 kg.



The acceptable range is 0.08 kg.



(2 marks)

(c) Make **one** comment on each graph in relation to the production process.

Mean:

.....

Range:

.....

(2 marks)

7 The duration, in minutes, of a sample of ten adventure films, is given in the table.

105	116	111	130	116
140	119	116	125	125

(a) Calculate the mean and standard deviation of the duration of the adventure films.

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Mean minutes

Standard deviation minutes
(4 marks)

(b) Assume that the duration of all adventure films is normally distributed with a mean of 120 minutes and a standard deviation of 9.3 minutes.
Explain why a film is unlikely to last for more than 155 minutes.

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(4 marks)

(c) The duration of romance films has a mean of 130 minutes and a standard deviation of 7.53 minutes.
Compare the duration of adventure and romance films.

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(2 marks)

Turn over ►

8 Medical practice A has 6 doctors.
Each doctor is equally likely to be on call.

(a) Describe how you could use a dice to simulate the selection of a doctor.

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(1 mark)

(b) Medical practice B collected data throughout 2001.
The following table shows the average number of patients, by age group, attending medical practice B per day.

Age	Patients
Under 16	38
16 to 59	35
60 and over	27
Total	100

Explain how you could use random numbers to simulate the ages of the next two people attending the medical practice.

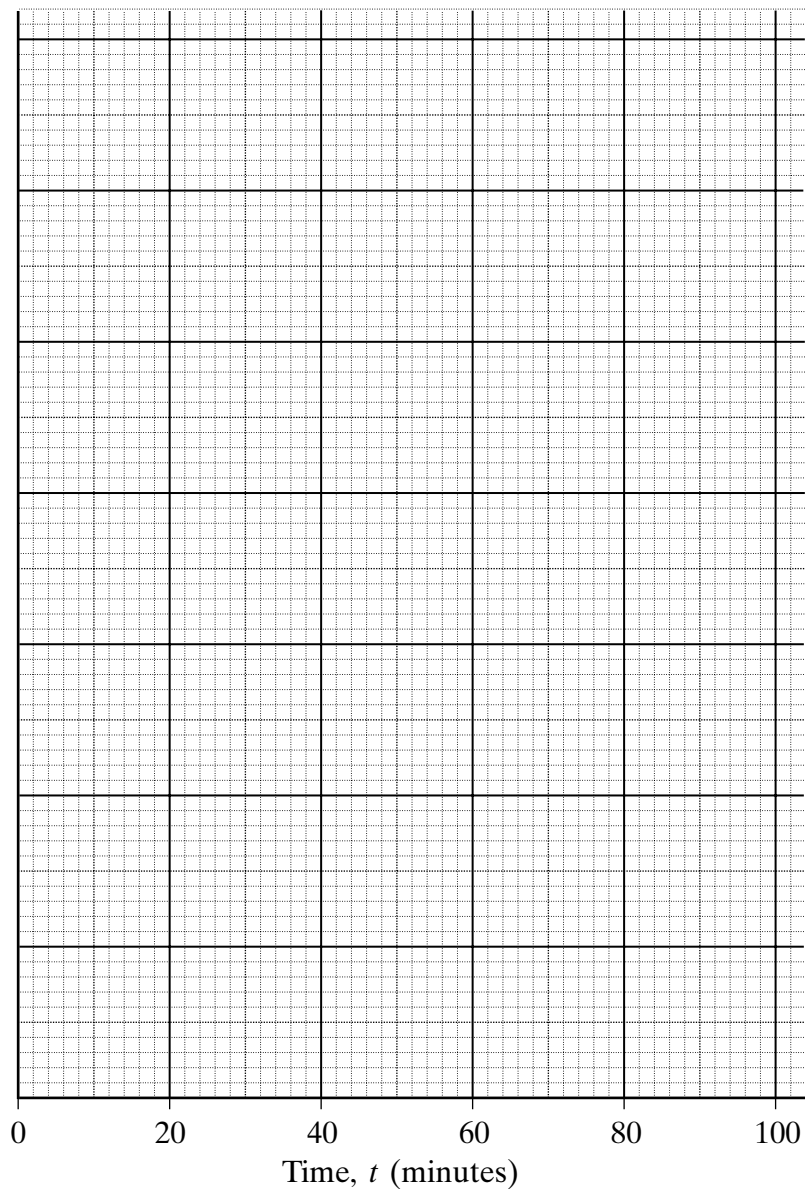
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(3 marks)

- 9 The time, in minutes, to the first goal in 140 football league matches is given in the table below. At least one goal was scored in each match.

Time, t	Number of matches
$0 < t \leq 10$	24
$10 < t \leq 20$	33
$20 < t \leq 25$	22
$25 < t \leq 35$	23
$35 < t \leq 45$	10
$45 < t \leq 60$	6
$60 < t \leq 75$	13
$75 < t \leq 90$	9

- (a) Draw a histogram to represent the data.



(5 marks)

(b) Describe the skewness of the data.

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(1 mark)

(c) Which measures of location and dispersion would be preferred for this data?
Give reasons for your choice.

.....
.....
(1 mark)

TURN OVER FOR THE NEXT QUESTION

Turn over 



- 10 (a) The table gives the population distribution by age in town Q and the number of deaths for each age group.

Age group	Population in thousands	Number of deaths
0 to under 17	25	463
17 to under 30	22	201
30 to under 45	23	257
45 to under 65	18	329
65 and over	14	589

Calculate the crude death rate for town Q.

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Answer (2 marks)

- (b) The population for the country in which town Q is situated is given below.

Age group	Population of the country in thousands
0 to under 17	260
17 to under 30	237
30 to under 45	197
45 to under 65	163
65 and over	98

Calculate the standardised death rate for town Q.

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Answer (6 marks)

(c) Why are standardised death rates better measures than crude death rates?

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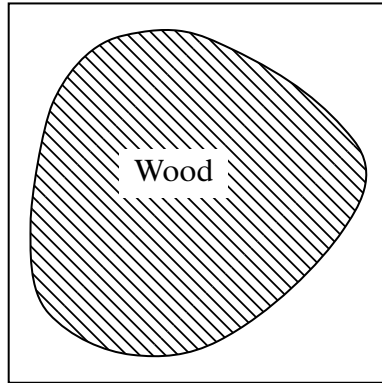
(1 mark)

TURN OVER FOR THE NEXT QUESTION

Turn over ▶



- 11 (a) Kalvinda wants to estimate the area of a wood. He draws a square surrounding the wood on a map. The map is drawn below. The area represented by the square is 25 km^2 . He plots 100 points at random. 70 of these points are in the wood.



Use these results to estimate the area of the wood.

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Answer km^2 (2 marks)

- (b) Sarah is going to plot 2 points at random on the map. Use the estimate obtained by Kalvinda to calculate the probability that exactly one of the points is in the wood.

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Answer (3 marks)

(c) John is going to plot 4 points at random.
He wants to calculate the probability that exactly 2 points are in the wood.

- (i) List the different orders in which the 4 points could be selected.
One is done for you.
You may not need all the available space.

In, In, Out, Out		

(1 mark)

- (ii) Calculate the probability that exactly 2 points are in the wood.

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Answer (3 marks)

TURN OVER FOR THE NEXT QUESTION

Turn over 

12 The number of sales made by a shop from 1999-2001 are given in the table below.

Period	Sales (1000's)	Three-point moving average
Jan – April 1999	30	
May – August 1999	27	30
Sept – Dec 1999	33	31
Jan – April 2000	33	32
May – August 2000	30	33.3
Sept – Dec 2000	37	34.3
Jan – April 2001	36	
May – August 2001	32	
Sept – Dec 2001	40	

(a) Give **one** reason why three-point moving averages are appropriate.

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 (1 mark)

(b) Calculate the value of the next two moving averages and write them in the table.

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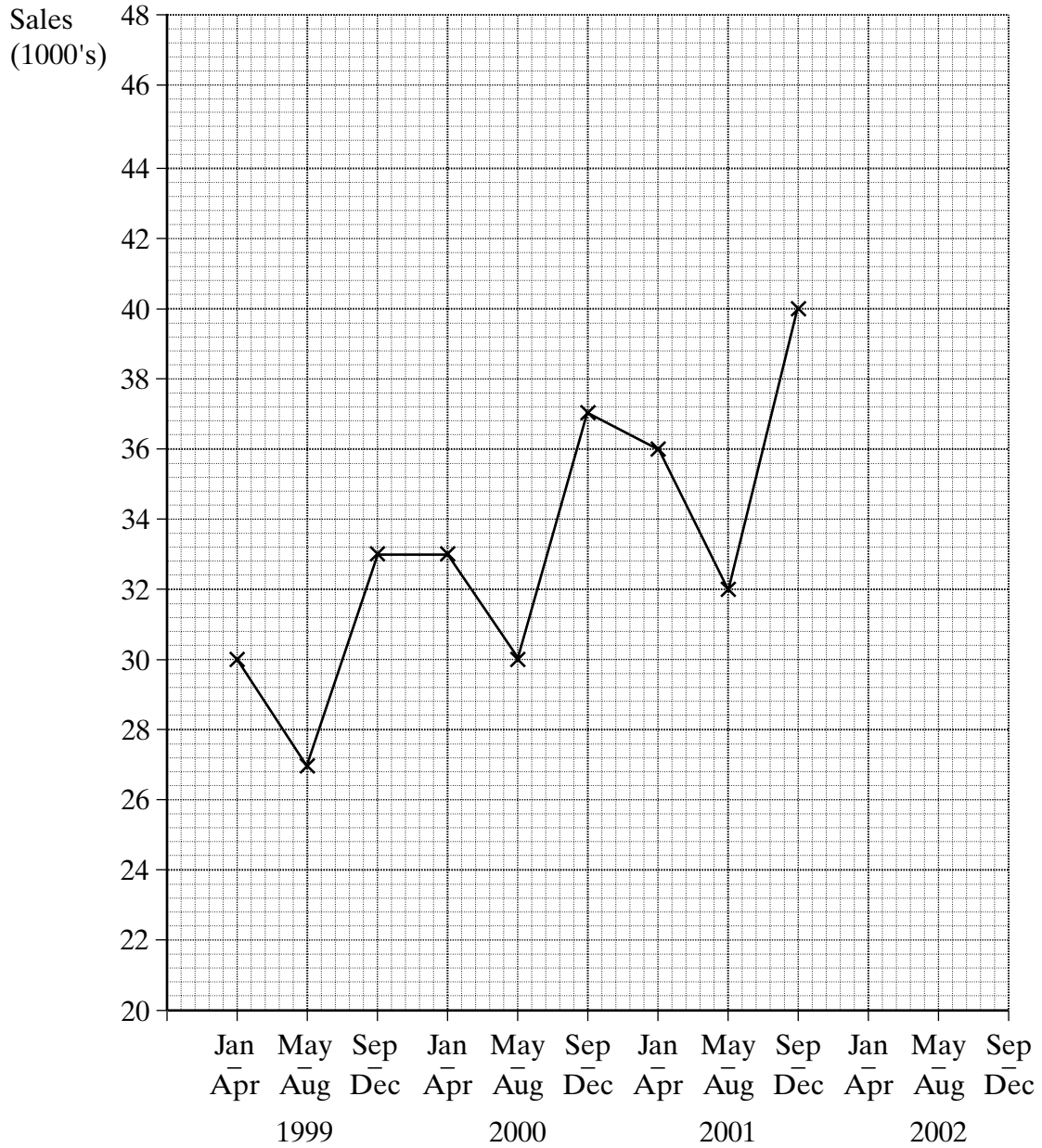
 (3 marks)

(c) Calculate the average seasonal variation for the periods May – August.

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Answer (2 marks)

(d) On the graph below plot all the three-point moving averages.



(2 marks)

(e) Predict the sales for May – August 2002.

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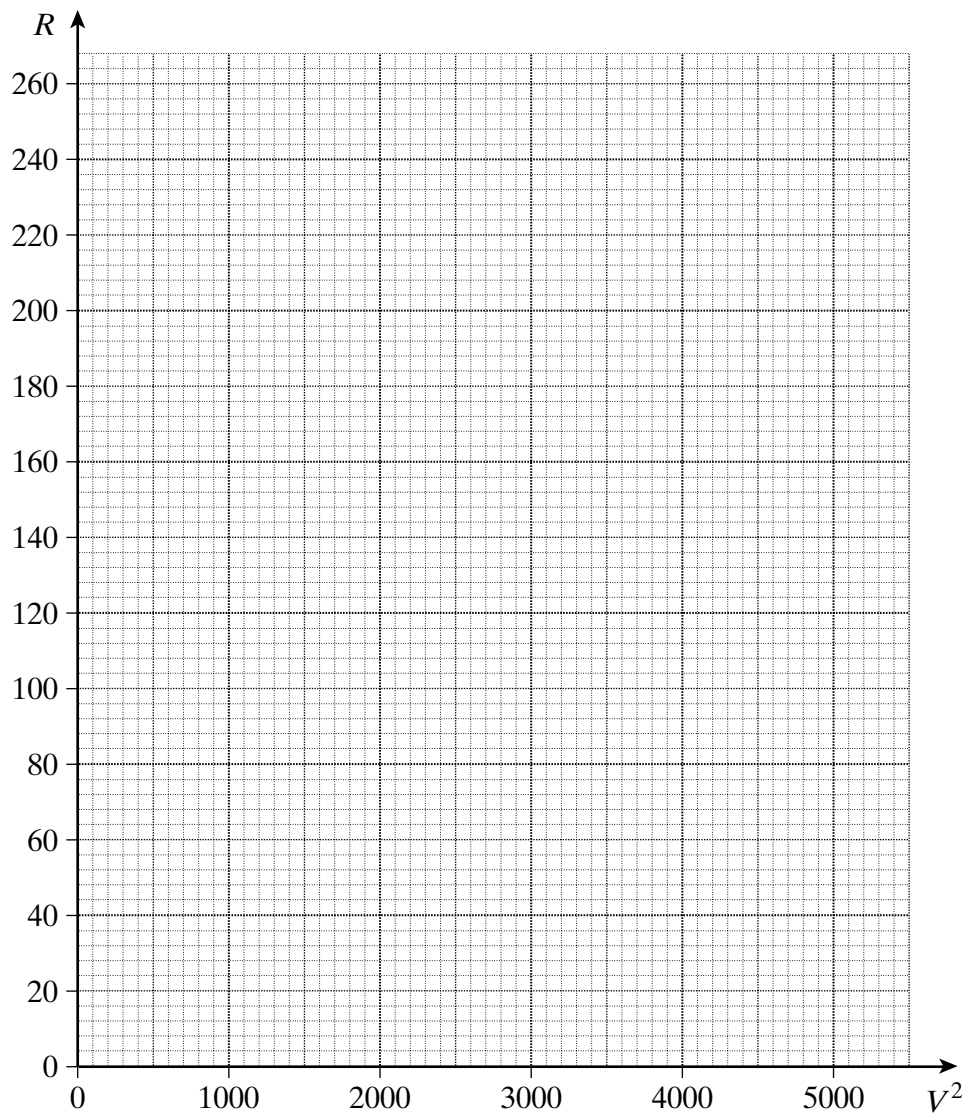
Answer (3 marks)

Turn over ►

- 13** The speed of a car, V km/h, and the total resistance to its motion, R newtons, are given in the table.

V	10	20	30	40	50	60	70
R	35	45	65	90	130	170	225
V^2							

- (a) Plot a graph of R against V^2 .



(3 marks)

(b) The mean of V^2 is 2000 and the mean of R is 109.
Draw a line of best fit on your graph. (2 marks)

(c) Write down the intercept with the R axis.

Answer (1 mark)

(d) Calculate the gradient of your line of best fit.

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Answer (3 marks)

(e) Write down a formula for R in terms of V^2 .

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Answer (1 mark)

(f) Use your formula to estimate the resistance to motion when the speed of the car is 90 km/h.

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Answer newtons (2 marks)

(g) Is this estimate reliable?
Give a reason for your answer.

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(1 mark)

END OF QUESTIONS