General Certificate of Education
Advanced Subsidiary Examination
January 2010

Statistics SS02

Unit Statistics 2

Friday 15 January 2010 1.30 pm to 3.00 pm

For this paper you must have:
- an 8-page answer book
- the blue AQA booklet of formulae and statistical tables
- an insert for use in Question 4 (enclosed).

You may use a graphics calculator.

Time allowed
- 1 hour 30 minutes

Instructions
- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Write the information required on the front of your answer book. The **Examining Body** for this paper is AQA. The **Paper Reference** is SS02.
- Answer **all** questions.
- Show all necessary working; otherwise marks for method may be lost.
- The **final** answer to questions requiring the use of tables or calculators should normally be given to three significant figures.
- Fill in the boxes at the top of the insert.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.

Advice
- Unless stated otherwise, you may quote formulae, without proof, from the booklet.

Answer **all** questions.

1 The table shows the quarterly expenditure, £ million, on gardens, plants and flowers by United-Kingdom-resident households from quarter 1 of 2004 to quarter 2 of 2007.

Year	Quarter	Expenditure (£ million)
2004	1	810
	2	1307
	3	682
	4	629
2005	1	833
	2	1221
	3	634
	4	640
2006	1	782
	2	1248
	3	721
	4	654
2007	1	910
	2	1363

Source: *Consumer Trends*, Office for National Statistics, Quarter 3, 2007

The data are plotted on **Figure 1** opposite, together with values of a suitable n-point moving average and a trend line.

(a) State the value of n. *(1 mark)*

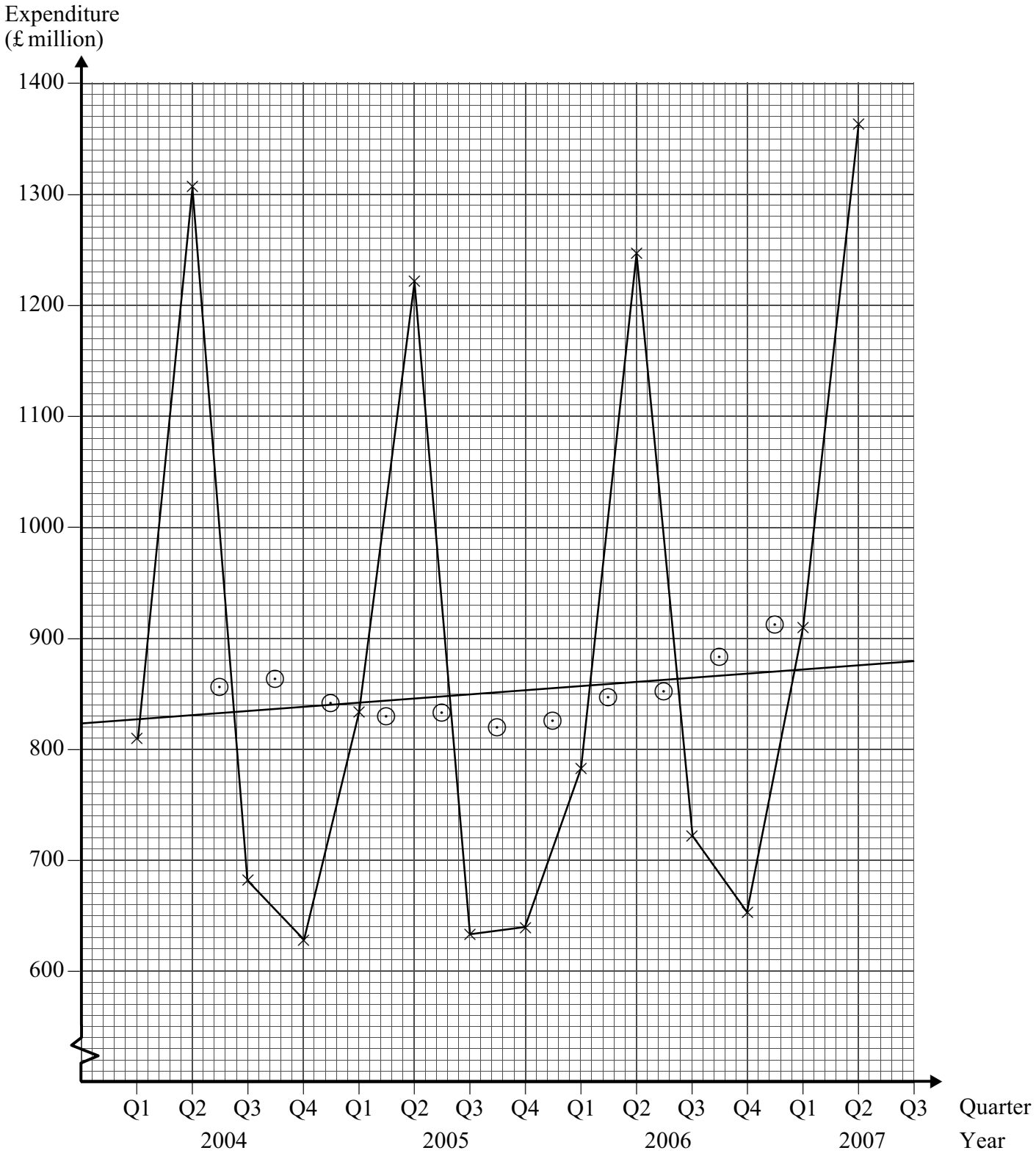
(b) Describe the variation exhibited by the moving average. *(3 marks)*

(c) Estimate the seasonal effect of the expenditure in quarter 3. *(3 marks)*

(d) Estimate the expenditure for quarter 3 of 2007, giving your answer to an appropriate level of accuracy. *(3 marks)*

Figure 1

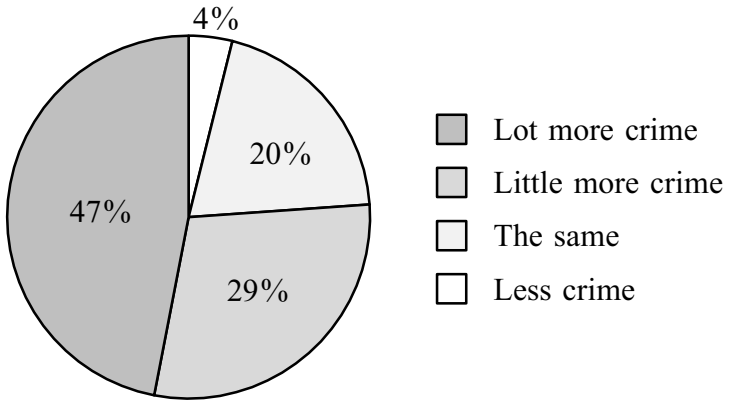
Expenditure by UK households on gardens, plants and flowers



2 Respondents to the British Crime Survey were asked, in 1995, whether they thought that there was more crime, the same amount of crime or less crime compared to 1993. The pie chart in **Figure 2** summarises the answers given.

Figure 2

Changes in crime



(a) In fact, the number of recorded crimes was 8% lower in 1995 than in 1993.

(i) Compare the answers given with this actual change in the number of recorded crimes. *(2 marks)*

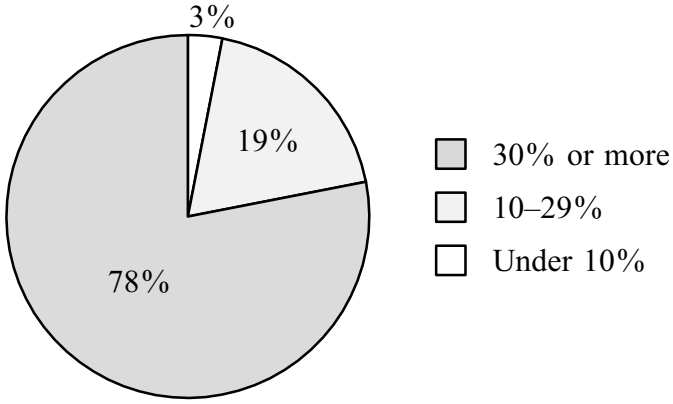
(ii) Suggest one possible reason for the difference, if any, between the actual change in recorded crime and the answers given. *(2 marks)*

(iii) Give a reason why a box and whisker plot cannot be constructed for the answers given. *(1 mark)*

(b) The pie chart in **Figure 3** summarises respondents' views on the proportion of crime which is violent.

Figure 3

How much crime is violent?



In the light of the fact that in 1995 about 6% of crime reported to the police in England and Wales was violent in nature:

(i) comment on the information given in the pie chart; *(2 marks)*

(ii) suggest a possible explanation, other than that given in your answer to part (a)(ii), for respondents' views. *(1 mark)*

3 A consumer organisation is investigating the service offered by companies supplying household gas.

(a) The waiting times, in seconds, between a telephone call connecting to a gas company, Northgas, and the caller actually speaking to one of its employees were recorded for nine telephone calls as follows:

76 157 62 56 193 34 89 185 134

Test, using the 5% significance level, whether the mean waiting time for calls made to Northgas exceeds 90 seconds. Assume that this sample is a random sample from a normal distribution with standard deviation 55 seconds. *(8 marks)*

(b) Another gas company, Southgas, claims that the waiting time for incoming telephone calls to its offices does not, on average, exceed 90 seconds.

A random sample of 85 telephone calls made to Southgas had a mean waiting time of 94 seconds and a standard deviation of 12 seconds. Test the claim made by Southgas using the 5% significance level. *(5 marks)*

(c) Angus, a member of the consumer organisation, compared the sample means from parts (a) and (b) and also the conclusions reached. He expressed surprise.

(i) Give a possible reason why Angus expressed surprise. *(2 marks)*

(ii) Identify one feature of the samples which explains why, despite his surprise, the conclusions are plausible. *(1 mark)*

4 [**Figure 4**, printed on the insert, is provided for use in this question.]

The following table shows the number of cinema screens, y, in the United Kingdom for each year from 1996 to 2004. Each year is also identified by a value of t, as shown in the table.

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004
t	1	2	3	4	5	6	7	8	9
Number of cinema screens, y	2166	2383	2638	2825	3017	3248	3402	3433	3475

Source: *Annual Abstract of Statistics*, Office for National Statistics, 2006

(a) Plot the data on **Figure 4**. *(2 marks)*

(b) Calculate the equation of the regression line of y on t.

Draw your line on **Figure 4**. *(5 marks)*

(c) Use your regression equation to forecast the number of cinema screens in the United Kingdom in 2006. *(2 marks)*

(d) Examine your graph and hence modify the forecast that you made in part (c). *(2 marks)*

Turn over ▶

5 Guaxara delivers post.

(a) The daily number of items, W, to be delivered to the first house on her round may be modelled by a Poisson distribution with mean 1.4.

Find the probability that on a particular day she has to deliver 2 or fewer items to the first house on her round. *(1 mark)*

(b) The daily number of items, X, to be delivered to the second house on her round may be modelled by a Poisson distribution with mean 3.6.

Find the probability that on a particular day:

(i) no items are to be delivered to the second house on her round; *(1 mark)*

(ii) the number of items to be delivered to the second house on her round is exactly 2; *(2 marks)*

(iii) the **total** number of items to be delivered to the first two houses on her round is more than 6. *(3 marks)*

(c) The daily number of items, Y, to be delivered to the third house on Guaxara's round may be modelled by the following probability distribution.

y	$\mathbf{P}(Y=y)$
0	0.24
1	0.27
2	0.29
3	0.12
4	0.08

Calculate the mean and the standard deviation of Y. *(5 marks)*

(d) The daily number of items, Z, delivered to the fourth house on her round has a mean of 1.9. Given that $\mathrm{E}((Z-1.9)^2)=2.89$, show that the standard deviation of Z is 1.7. *(1 mark)*

(e) (i) State which of W, X, Y and Z is, on average, the largest.

(ii) Determine which of W, X, Y and Z is the least variable, justifying your answer. *(4 marks)*

6 An organisation employs a large number of examiners to mark scripts. The organisation wishes to consult a sample of examiners on various matters, including whether they would prefer their meetings to be held in London or Manchester. The following table summarises the locations of those examiners who live in England.

Region	Number of examiners
East Anglia	34
East Midlands	46
North	54
North West	21
South East	98
South West	73
West Midlands	62
Yorkshire and Humberside	12

(a) Describe how a simple random sample of size 40 could be selected from these examiners. *(5 marks)*

(b) David proposes that four regions should be selected at random and then ten examiners selected at random from each of these regions. A visit would be arranged to each of the chosen examiners.

(i) Name this method of sampling. *(1 mark)*

(ii) Give one advantage of this method of sampling. *(1 mark)*

(iii) Give, in context, one disadvantage of this method of sampling. *(2 marks)*

(iv) Would each examiner have an equal chance of being included in this sample? Justify your answer. *(2 marks)*

(c) It is pointed out to David that examiners could be asked for their views by telephone or by e-mail.

Explain whether or not your answer to:

(i) part (b)(ii) remains valid;

(ii) part (b)(iii) remains valid. *(2 marks)*

END OF QUESTIONS

There are no questions printed on this page

ACKNOWLEDGEMENT OF COPYRIGHT-HOLDERS AND PUBLISHERS

Copyright material in Questions 1, 2 and 4 is reproduced under the terms of the Click-Use Licence.