

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

Leave blank



**General Certificate of Education
Advanced Subsidiary Examination
June 2015**

Statistics

Unit Statistics 2

SS02

Friday 5 June 2015 9.00 am to 10.30 am

For this paper you must have:

- the insert
 - the blue AQA booklet of formulae and statistical tables.
- You may use a graphics calculator.**

TIME ALLOWED

- 1 hour 30 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

BLANK PAGE

INSTRUCTIONS

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer ALL questions.
- Write the question part reference (eg (a), (b)(i) etc) in the left-hand margin.
- You must answer each question in the space provided for that question. If you require extra space, use an AQA supplementary answer book; do NOT use the space provided for a different question.
- Show all necessary working; otherwise marks for method may be lost.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- The FINAL answer to questions requiring the use of tables or calculators should normally be given to three significant figures.

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.
- You do not necessarily need to use all the space provided.

DO NOT TURN OVER UNTIL TOLD TO DO SO

Answer ALL questions.

Answer each question in the space provided for that question.

- 1 Researchers conducted a trial of a new drug intended to reduce pain after surgery. Immediately after their surgery, the patients in the trial received either the usual pain-reduction drug or the new drug. Later, 24 hours after the surgery, the patients recorded their Perceived Pain Index (PPI), where a higher score represents greater pain.**

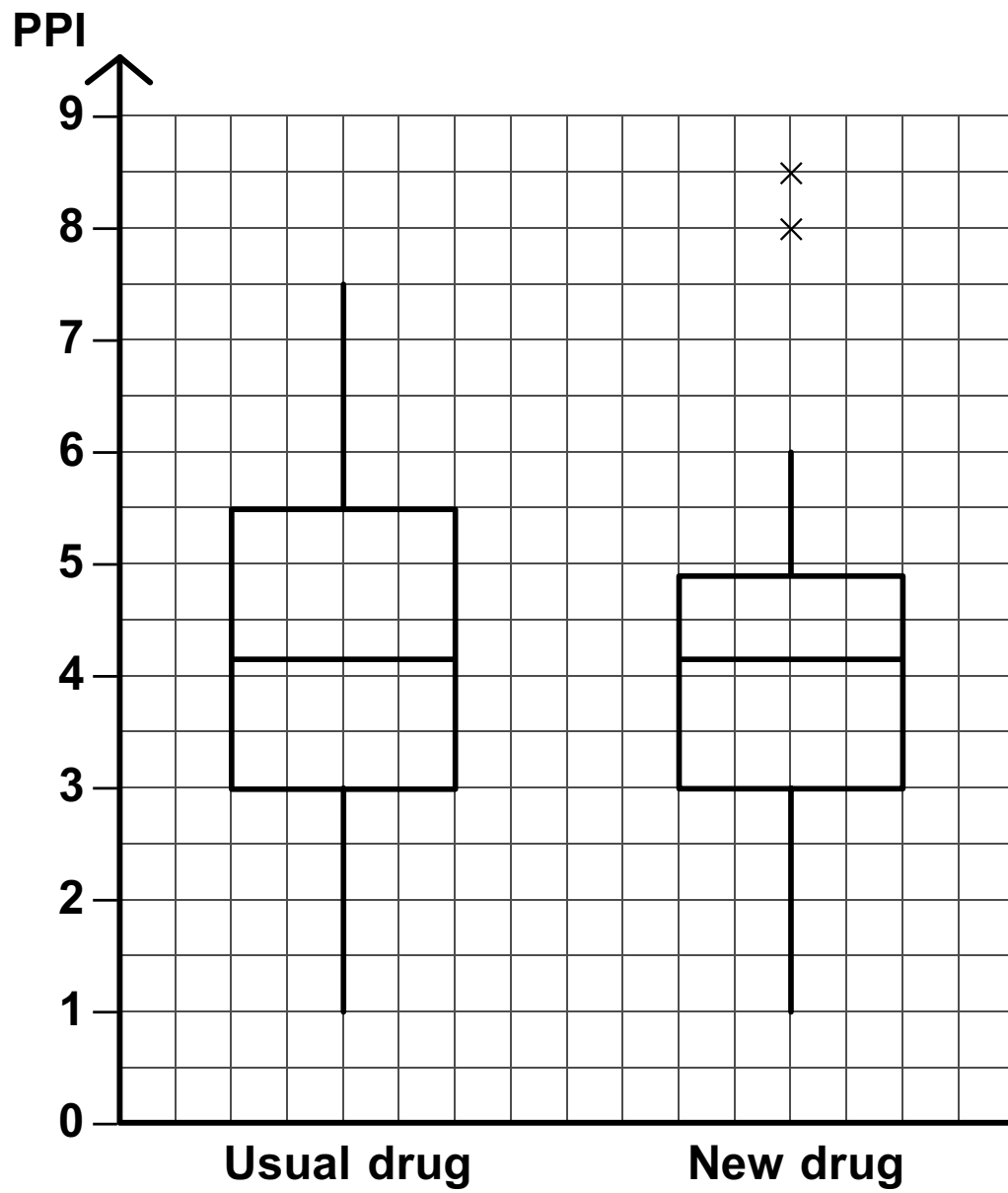
On the opposite page the box plots in FIGURE 1 illustrate the data from the trial. The plot for the patients receiving the new drug includes two outliers.

- (a) State the highest value of PPI recorded during the trial. [1 mark]**
- (b) When comparing the data from the two groups of patients, one of the researchers made the following statement.**

“The lowest value of PPI is the same for both drugs, but only the new drug has outliers.”

Make THREE further comments comparing the data from the two groups of patients as illustrated in FIGURE 1. Your answer should include at least one similarity and at least one difference. [3 marks]

FIGURE 1



[illegible]

[Turn over]

1. *Journal of the American Medical Association*, 1997; 277: 1039-1043.

[Turn over]

[illegible]

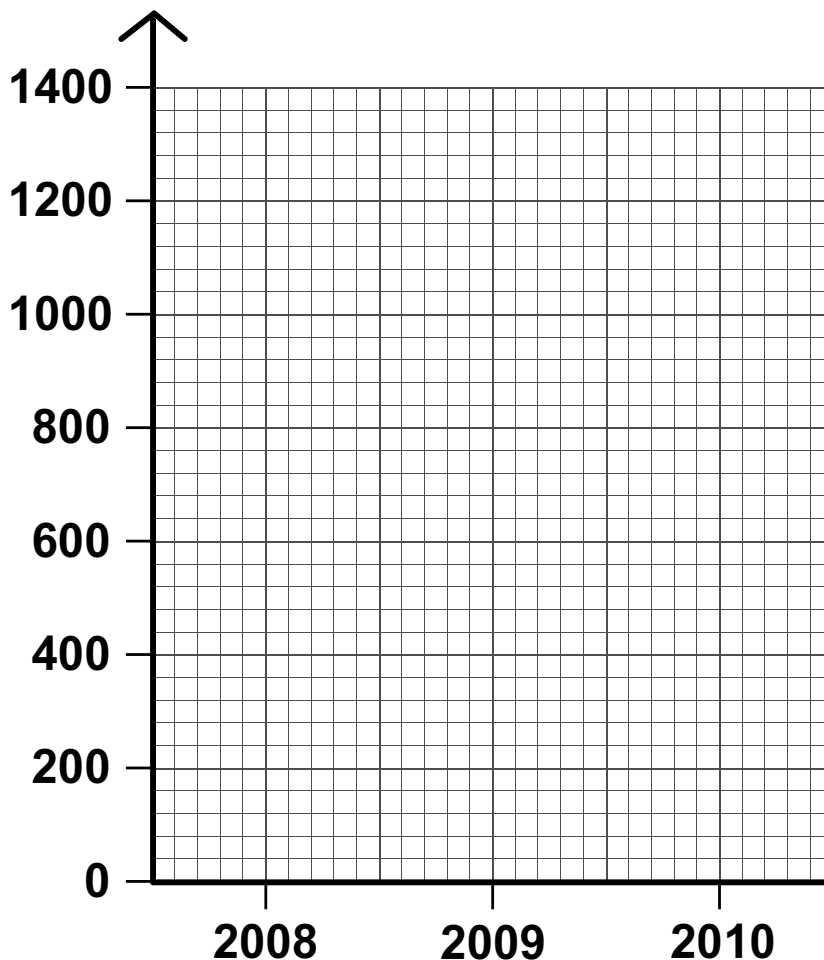
- (e) (i) On FIGURE 2, printed below, draw a line diagram to illustrate the number of enterprises engaged in 'Other food service activities' over the three years. [1 mark]
- (ii) Comment on the trend shown in the line diagram. [1 mark]

Answer space for question 2(e)

FIGURE 2

Number of other food service activity enterprises

Number of enterprises



[Turn over]

[illegible]

[Turn over]

- 3 Rika is the manager of a large department store. She believes that the longer their customers stay in the store, the more they are likely to buy. Rika found that customers were spending an average of 24·0 minutes in the store.**

In an attempt to encourage customers to stay longer, Rika arranged for relaxing music to be played throughout the store. After the music had been introduced, a sample of 120 customers was observed. The mean time spent in the store by these customers was 25·9 minutes, and the standard deviation was 9·5 minutes.

- (a) State an assumption that must be made in order to use this sample as a basis for a hypothesis test. [1 mark]**
- (b) Assuming that the assumption that you stated in part (a) is valid, test whether the mean time spent in the store by customers has increased. Use the 2% level of significance. [7 marks]**
- (c) After the music had been introduced, the mean time spent in the store by customers was, in fact, 25·4 minutes. State, with a reason, whether, in your conclusion in part (b), you made a Type I error, a Type II error or no error. [2 marks]**

[Turn over]

[illegible]

[Turn over]

- 4 At a remote hospital, in an area where there are many venomous snakes, the number of patients during one week requiring treatment after a venomous snakebite may be modelled by a Poisson distribution with mean 0.5 .**

(a) For this hospital, find the probability that:

- (i) no more than 1 patient requires treatment after a venomous snakebite during a particular week;
[1 mark]**
- (ii) at least 5 patients require treatment after a venomous snakebite during a particular period of 8 weeks; [3 marks]**
- (iii) more than 10 patients but fewer than 20 patients require treatment after a venomous snakebite during a particular period of 26 weeks.
[4 marks]**

- (b) Each patient who has been bitten by a venomous snake is treated with a single dose of an antivenom which is effective against the venoms of all the snakes common in that area.**

The antivenom is expensive and has a limited shelf life, so a delivery of fresh antivenom is made at 4-week intervals.

The hospital stores just enough antivenom so that the probability that it runs out of antivenom before the next delivery is less than 1 per cent.

Quoting probabilities to justify your answer, state how many doses of antivenom the hospital should have in its store immediately after a delivery of fresh antivenom. [3 marks]

[Turn over]

[illegible]

[Turn over]

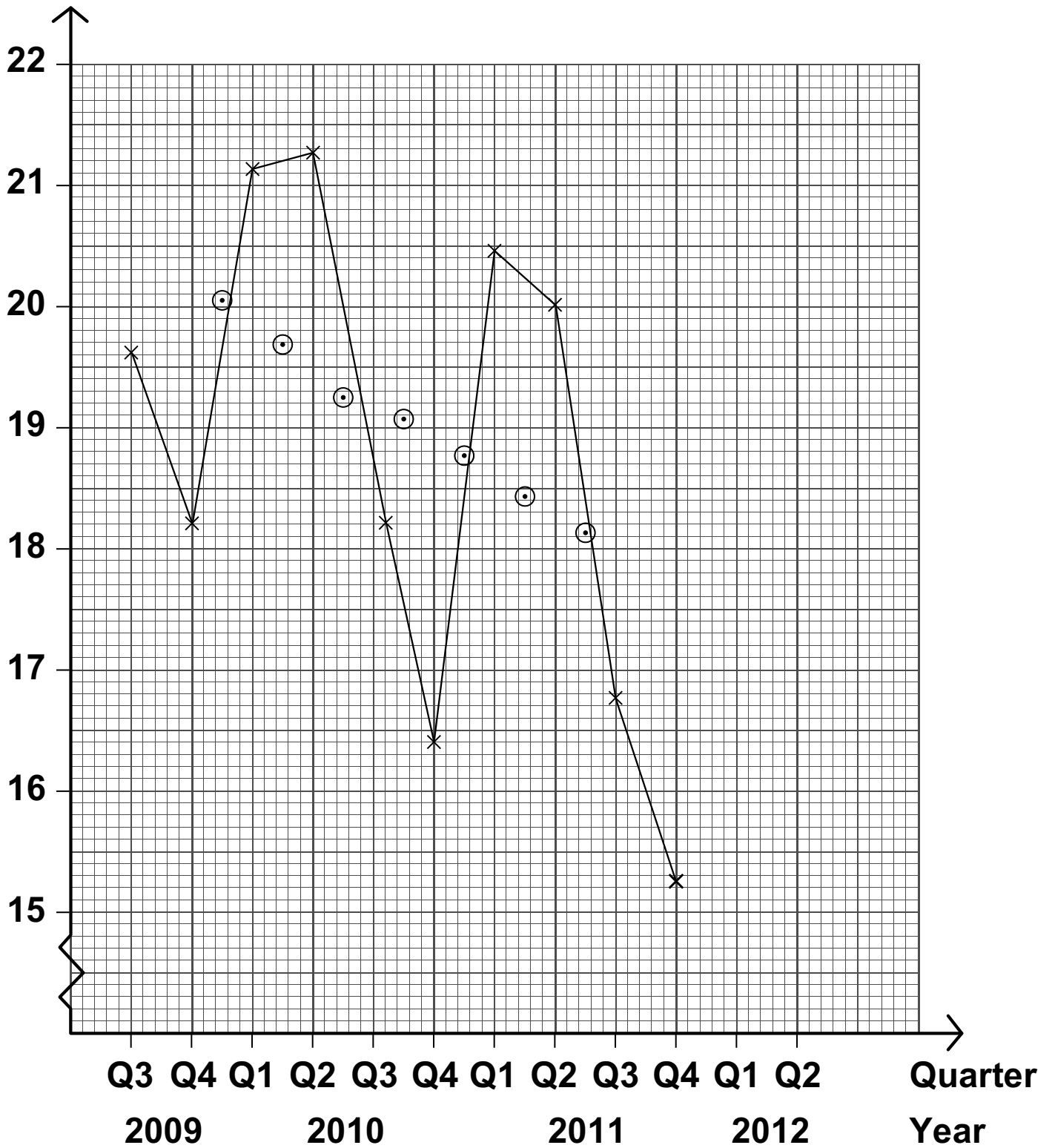
- 5 The table, printed on the insert, shows the quarterly numbers of cars first registered in Slovenia from quarter 3 of 2009 to quarter 4 of 2011 together with values of an appropriate n -point moving average.**

The data and moving averages are plotted in FIGURE 3, printed on the opposite page.

- (a) State the value of n . [1 mark]**
 - (b) Draw a trend line on FIGURE 3. [1 mark]**
 - (c) Using your trend line, estimate the seasonal effect for quarter 1. [3 marks]**
 - (d) Based on these data, forecast the number of registrations for quarter 1 of 2012. Clearly indicate the method you use in order to obtain your forecast. [3 marks]**
 - (e) The numbers of cars first registered in Slovenia in quarter 1 and in quarter 2 of 2012 were 18 070 and 17 842 respectively.**
 - (i) Mark these two data points on FIGURE 3.**
 - (ii) Calculate the next two moving averages and mark these on FIGURE 3.**
 - (iii) Comment on the trend and on the accuracy of your forecast in part (d).**
- [6 marks]**

FIGURE 3

Registrations
(1000s)



[Turn over]

[illegible]

[Turn over]

[Turn over]

[illegible]

BLANK PAGE

Turn over for question 6

- 6 The Goodwell Medical Practice has a total of 3200 registered patients. The local health authority has asked this practice to complete questionnaires about a sample of 40 patients, but has not said how this sample should be chosen.**

The practice has available a list of patients ordered alphabetically by their family name. The patients are numbered in the list from 1 to 3200. The details of 20 patients are printed on each page of the list.

- (a) Dr Dobry suggests picking two pages at random from the list and using the patients on those pages as the sample.**
- (i) Name this method of sampling.**
 - (ii) Give a reason why Dr Dobry's method would be unlikely to give a representative sample.
[2 marks]**
- (b) Dr Kalos suggests obtaining the sample of 40 from the list by a systematic method. Explain briefly how this could be done. [2 marks]**
- (c) Dr Bueno says the sample should be chosen at random in such a way as to proportionately represent the age distribution of the patients.**
- (i) Name this method of sampling.**
 - (ii) Given that there are 737 registered patients aged over 60 years, how many of these should be chosen in a sample of 40 chosen using Dr Bueno's method? [3 marks]**

(d) Dr Mabuti suggests obtaining a simple random sample by the following method.

- **Obtain a four-digit random number from tables, rejecting any number above 9599 .**
 - **Divide the number by 3200 and find the remainder.**
 - **Add 1 to this remainder.**
 - **Select the patient in the list corresponding to this number.**
 - **Carry out this procedure 40 times.**
- (i) Using this method, which number of the patient in the alphabetical list would be generated by the random number 5817 ?**
- (ii) Explain why it is necessary to reject any random number above 9599 .**
- (iii) Explain why it is necessary to add 1 .**
- (iv) Dr Mabuti has omitted one instruction which is needed to make sure this method gives a simple random sample of patients. What instruction needs to be added? [5 marks]**

[Turn over]

[illegible]

[Turn over]

[illegible]

[Turn over]

[illegible]

[Turn over]

- 7 Every Saturday evening, Angus runs a disco at the village hall. The hall must be tidied and cleaned on the morning of the following day, Sunday. This is done by Angus and a variable number of volunteers.**

Angus keeps a record of the number of volunteers, X , and the probability distribution for X is given in the table.

x	0	1	2	3	4	5	6 or more
$P(X = x)$	p	0.15	0.20	0.21	0.18	0.14	0

- (a) (i) Find the value of p .**
- (ii) Interpret the implication for Angus of this value of p .**
- [2 marks]**
- (b) Find the mean value of X and show that, correct to three significant figures, the standard deviation of X is 1.57 . [5 marks]**
- (c) It is suggested that a Poisson distribution may provide an adequate model for X .**
- (i) Comment on whether your answers in part (b) support this suggestion.**
- (ii) Give a reason why, IN THIS CONTEXT, a Poisson distribution may not be an appropriate model.**
- [3 marks]**

- (d) Every Sunday morning, Angus and any volunteers must also carry 120 chairs into the hall and arrange them for a meeting to be held later that day.

They share this task equally. Hence, the number of chairs, N , which each of them carries into the hall is given by

$$N = \frac{120}{(X + 1)}$$

- (i) Find the probability that Angus carries exactly 20 chairs into the hall next Sunday morning.
- (ii) Construct a table showing the probability distribution for N .
- (iii) Find the mean number of chairs carried into the hall by Angus on a Sunday morning.

[6 marks]

[Turn over]

[illegible]

[Turn over]

[illegible]

[Turn over]

[illegible]

END OF QUESTIONS

BLANK PAGE

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

BLANK PAGE