Surname ______________________________

Other Names ______________________________

Centre Number ______________________________

Candidate Number ______________________________

Candidate Signature ______________________________

AS
STATISTICS

Unit Statistics 2

SS02

Wednesday 15 June 2016 Morning

Time allowed: 1 hour 30 minutes

For this paper you must have:
- **the blue AQA booklet of formulae and statistical tables**
- **the insert.**

You may use a graphics calculator.

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

[Turn over]

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.
- Do not write on blank pages.
- 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 The heights of a sample of 240 female students and 240 male students were measured.

The data for the female students are summarised as a box plot in Figure 1 opposite.

The data for the male students are summarised as a cumulative frequency graph in Figure 2 on page 6.

Using the information in the two figures, compare the distribution of heights for the female students with that for the male students. You should make reference to the difference, if any, between:

(a) the average values of height;

(b) the values of a measure of spread;

(c) the symmetry, or otherwise, of the two distributions. [6 marks]

Answer space for question 1
Write the question part reference in the left margin.

FIGURE 1

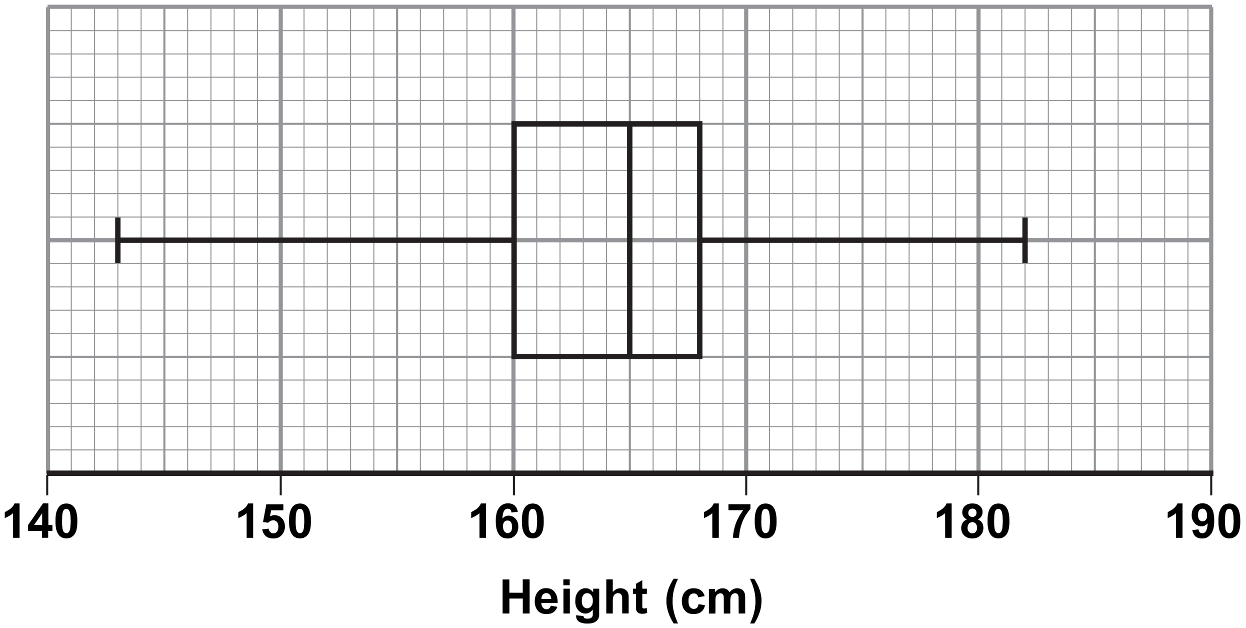
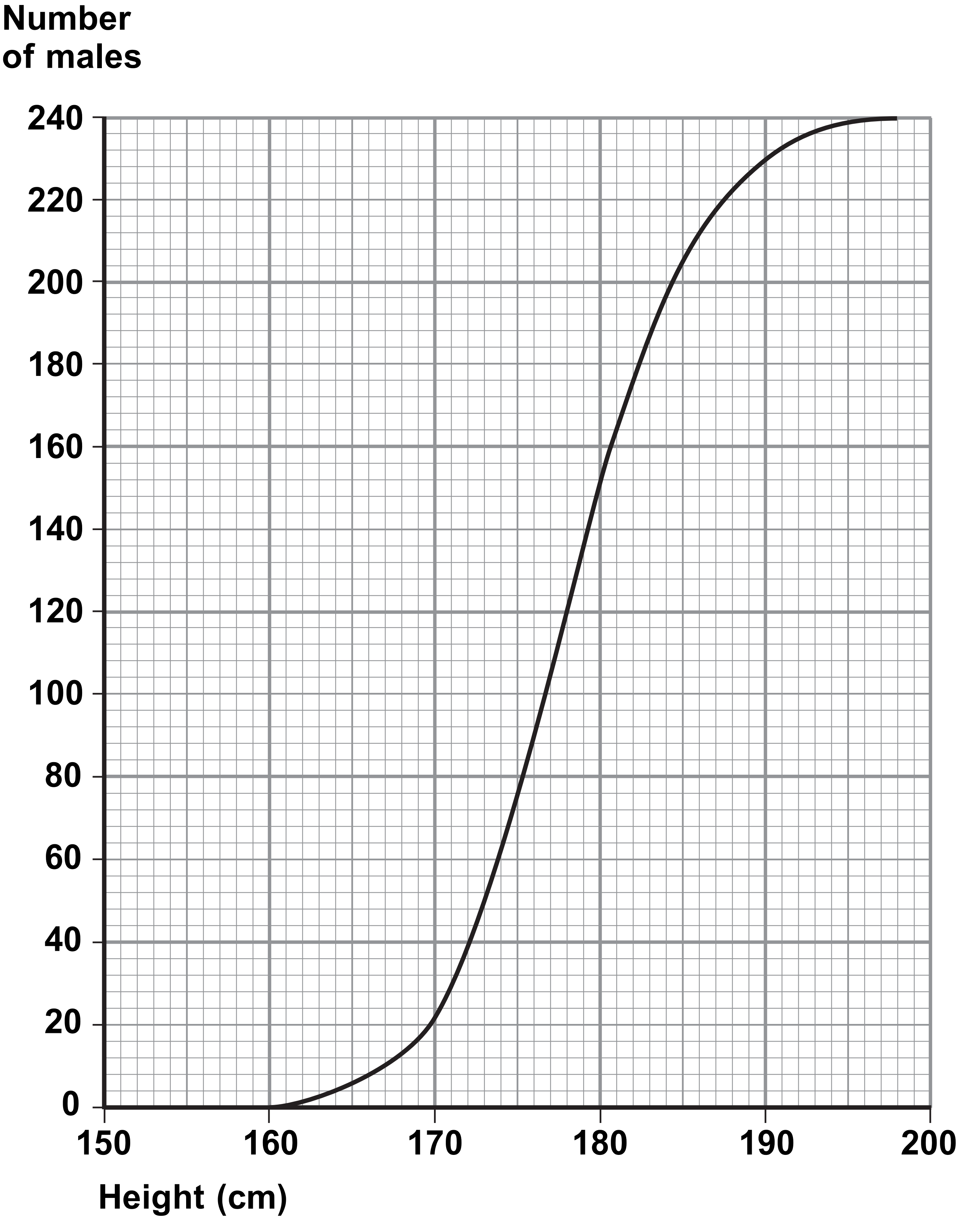


FIGURE 2


Number
of males
240
220
200
180
160
140
120
100
80
60
40
20
0
150
160
170
180
190
200
Height (cm)

[Turn over]

2 A ticket purchased at a car park allows parking for a period of up to 1, 2, 3, 4, 8 or 24 hours. The ticket must be displayed in the parked car. The percentage of purchases of each type of ticket are shown in the table.

TYPE OF TICKET	PERCENTAGE
Up to 1 hour	12
Up to 2 hours	19
Up to 3 hours	18
Up to 4 hours	21
Up to 8 hours	10
Up to 24 hours	20

(a) (i) Find the probability that the ticket displayed in a randomly chosen car at this car park allows parking for a period of more than 3 hours.
[1 mark]

(ii) There are two yellow cars in the car park each displaying a ticket.

Calculate the probability that the two tickets displayed are of the same type. [2 marks]

(b) The charge for parking at this car park is 50p PER HOUR for any period up to 4 hours. There are fixed charges of £3 for up to 8 hours and £5 for up to 24 hours.

(i) Find the mean amount paid for a parking ticket at this car park and show that the standard deviation is £1·53 correct to three significant figures. [5 marks]

(ii) Find the probability that the amount paid for a parking ticket is within one standard deviation of the mean. [2 marks]

Answer space for question 2
Write the question part reference in the left margin.

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[Turn over]

3 The table, on the insert, shows, by mode of travel for the period 1980 to 2013, the numbers of visits abroad by UK residents and the amounts that they spent.

(a) The total number of visits tabulated for 1983 is less than the sum of the tabulated number of visits by air and by sea in 1983. Give a reason why this has happened. [1 mark]

(b) Calculate the average amount spent per visit by UK residents travelling abroad by sea in 1999. Give your answer to the nearest pound (£). [2 marks]

(c) Calculate the PERCENTAGE REDUCTION in total spending by UK residents travelling abroad in 2009, compared with that in 2008. [2 marks]

(d) Kayla wants to draw two comparative pie charts for 1980 and 2013, to illustrate the NUMBERS OF VISITS and the modes of travel. She will use a circle with radius 5 cm for the 1980 chart.

(i) Calculate the angle that Kayla should use for the sector representing air travel in 1980. [2 marks]

(ii) Calculate the radius of the circle that Kayla should use for the 2013 pie chart. [3 marks]

Answer space for question 3

Write the question part reference in the left margin.

[Turn over]

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[Turn over]

4 A hospital records data about the causes of injuries suffered by people who are treated at its Accident and Emergency department. The data show that injuries associated with duvets occur at an average rate of 6 per year, and that injuries associated with cushions occur at an average rate of 5 per year.

(a) Assuming that all such injuries are random and independent, find the probability that, at this hospital:

(i) during a period of 1 year, exactly 4 people are treated for DUVET-associated injuries; [2 marks]

(ii) during a period of 4 months, no more than 2 people are treated for DUVET-associated injuries; [2 marks]

(iii) during a period of 2 years, at least 8 people are treated for CUSHION-associated injuries; [2 marks]

(iv) during a period of 1 year, more than 5 people but fewer than 15 people are treated for injuries associated with duvets or cushions. [3 marks]

(b) Given that duvets are used more during the winter months than the summer months, explain why your answer to part (a)(ii) may not be valid. [1 mark]

Answer space for question 4

Write the question part reference in the left margin.

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[Turn over]

5 The mean blood cholesterol level of the adult residents of a particular country has been found to be 5·8 millimoles per litre (mmol/l).

Monica is a researcher who believes that the daily consumption of yoghurt can reduce blood cholesterol level. She selected a sample of 80 such residents who consumed yoghurt daily and measured the blood cholesterol level, X mmol/l, of each resident, obtaining the following summarised results.

$\sum x = 452{\cdot}8$ and $\sum (x - \bar{x})^2 = 33{\cdot}552$

(a) Show that the results support Monica's belief at the 10% significance level. [8 marks]

(b) Monica would like to publish the result of her research with the following statement.

"The belief that eating yoghurt daily can reduce blood cholesterol level was supported by my research at the α% significance level."

State the smallest integer value of α that Monica can use, quoting probabilities to justify your answer. [2 marks]

(c) Given that the daily consumption of yoghurt actually has no significant effect on blood cholesterol levels, state whether Monica made a Type I error, a Type II error or no error. [1 mark]

Answer space for question 5
Write the question part reference in the left margin.

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[Turn over]

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[Turn over]

6 Wedlock council is responsible for three villages: Lower Wedlock, Middle Wedlock and Upper Wedlock. A recent census has shown that the adult populations of the three villages are as in the table.

	Male	**Female**
Lower Wedlock	**254**	**327**
Middle Wedlock	**844**	**897**
Upper Wedlock	**1185**	**1243**

The council has to consider a proposal for a supermarket to be built somewhere near the three villages and wishes to discover the opinions of the residents.

(a) Other than bias introduced by the difference in the sizes of the populations of the three villages, give a reason why a questionnaire delivered to each household would be likely to give a biased view of the residents' opinions. [1 mark]

(b) The council considers conducting interviews with a sample of 80 residents to determine their opinions. The electoral register, which lists the residents of the three villages separately by household, would be used as the sampling frame.

(i) Describe, in detail, how the table of random numbers in the booklet of formulae and statistical tables (Table 13) could be used to select the sample of 80 residents from the electoral register. [4 marks]

(ii) Explain why a random sample from this register may not provide a representative view of the residents' opinions. [1 mark]

(iii) Explain why a sample selected systematically from this register may be more representative than a random sample, but may not be completely representative. [2 marks]

(c) In fact, the council decides to conduct interviews with a stratified sample of 80 residents, reflecting the proportions of males and females and the populations of the three villages. The sample will be collected by quota sampling of residents as they visit the post office in each village.

Describe, in detail, how this sample could be chosen, including the numbers of residents in the various quotas. [5 marks]

Answer space for question 6
Write the question part reference in the left margin.

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[Turn over]

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[Turn over]

7 Rodney runs a market stall every Monday, Wednesday and Friday in a small town. The stall is less busy during the winter months.

Rodney kept a record of his takings each day in October. The values of his takings, in £, for the first three weeks are shown in the table, together with an appropriate moving average.

Day	Date	Takings	Moving average
Monday	1	323	
Wednesday	3	400	368
Friday	5	381	361
Monday	8	302	344
Wednesday	10	349	329
Friday	12	336	315
Monday	15	260	305
Wednesday	17	319	m
Friday	19	294	

(a) Calculate the value of the missing moving average, m. [2 marks]

(b) The values of the takings have been plotted on Figure 3, on page 50.

Plot the moving averages on this figure and draw a trend line. [2 marks]

(c) (i) Name the type of variation shown by the moving averages about the trend line.

(ii) Name the type of variation shown by the takings about the trend line. [2 marks]

(d) Using the data and the trend line, find the seasonal effect for:

(i) Monday;

(ii) Friday. [3 marks]

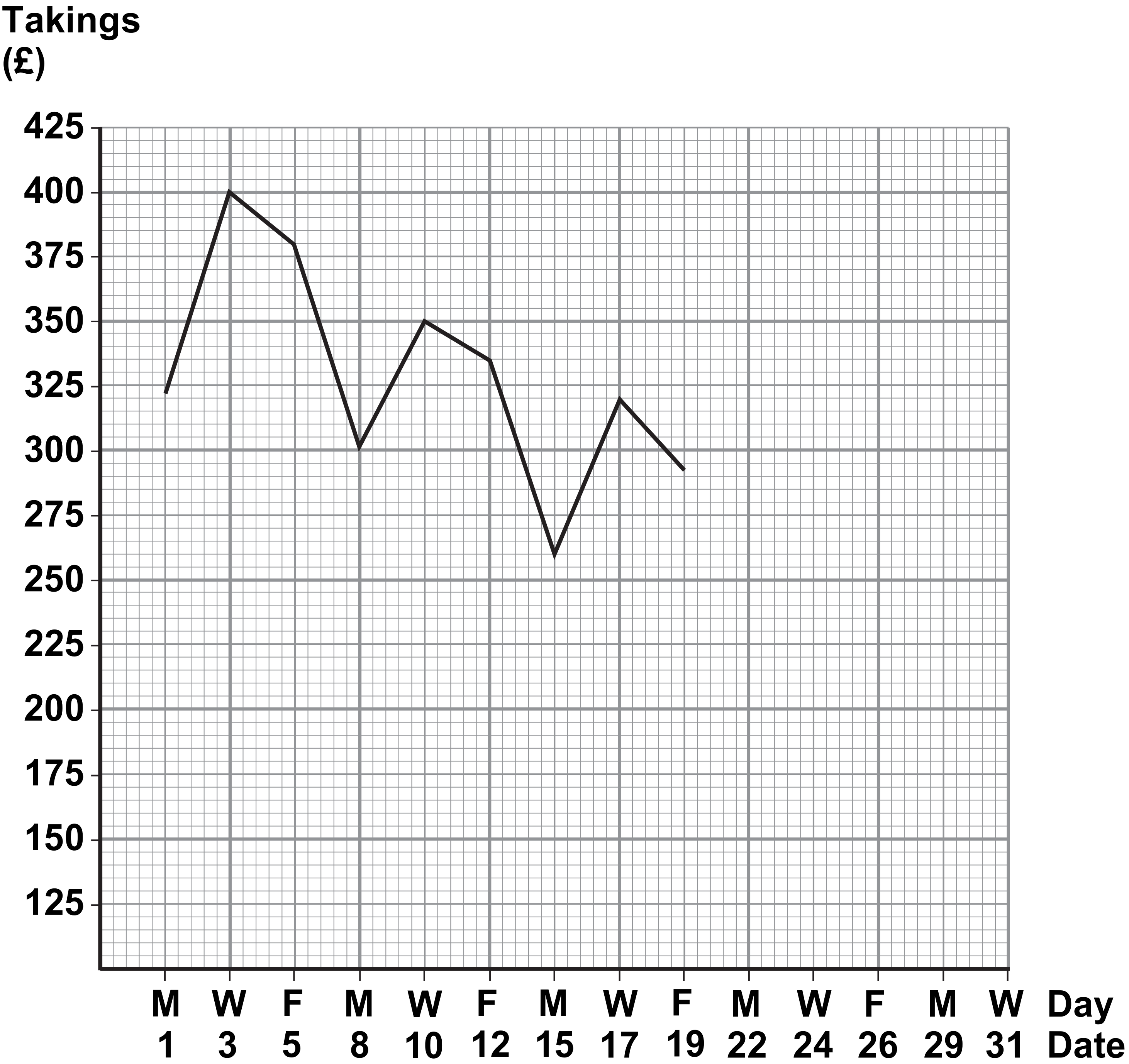
(e) Showing your method, estimate the takings on Friday 26 October. [3 marks]

(f) Rodney will stop running his stall if the takings for any day fall below £200 . Assuming that the current trend continues, estimate on which day this will occur. Show calculations to support your estimate. [3 marks]

[Turn over]

Answer space for question 7
Write the question part reference in the left margin.

FIGURE 3



END OF QUESTIONS