Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

STATISTICS **4040/13**

Paper 1 **October/November 2016**

2 hours 15 minutes

Candidates answer on the Question Paper.

Additional Materials: Pair of compasses
Protractor

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions in Section A and not more than **four** questions from Section B.
If working is needed for any question it must be shown below that question.
The use of an electronic calculator is expected in this paper.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

DC (CW/CGW) 134135/1

CAMBRIDGE
International Examinations

[Turn over

Section A [36 marks]

Answer **all** of the questions 1 to 6.

1 The main sources of energy in the human diet are carbohydrates, proteins and fats. A nutritionist recommends the following percentages from each of these sources.

Source	*Percentage of total energy*
Carbohydrates	55%
Proteins	15%
Fats	30%

This information is to be illustrated in a pie chart of radius 4 cm.

(i) Calculate, in degrees, the angle of each sector.

Carbohydrates ..... °

Proteins ..... °

Fats ..... °

[2]

(ii) Draw and label the pie chart.

[2]

2 Flights from an airport have either a domestic or an international destination. For each scheduled departure the flight is categorised as on time, delayed or cancelled.
On one particular day there were 50 scheduled departures, of which 3 were cancelled, and 4 were delayed domestic flights, as shown in the following table.

Destination	*Flight departure*			TOTAL
	On time	Delayed	Cancelled	
Domestic		4		
International				
TOTAL			3	50

No domestic flights were cancelled.

(i) Use this information to insert two numbers into the table. [1]

Twice as many international flights as domestic flights were delayed.

(ii) Use this information to insert three more numbers into the table. [2]

80% of the scheduled departures were international flights.

(iii) Use this information to complete the table. [3]

[Turn over

3 The atmospheric pressure in a town at mid-day was measured every day for one week. The following results, in millibars (mb), were obtained.

1012 1004 996 993 999 1000 1010

(i) **Using an assumed mean of 1000 mb** and showing your working, find the mean and standard deviation of these values.

Mean = ...

Standard deviation = ...[4]

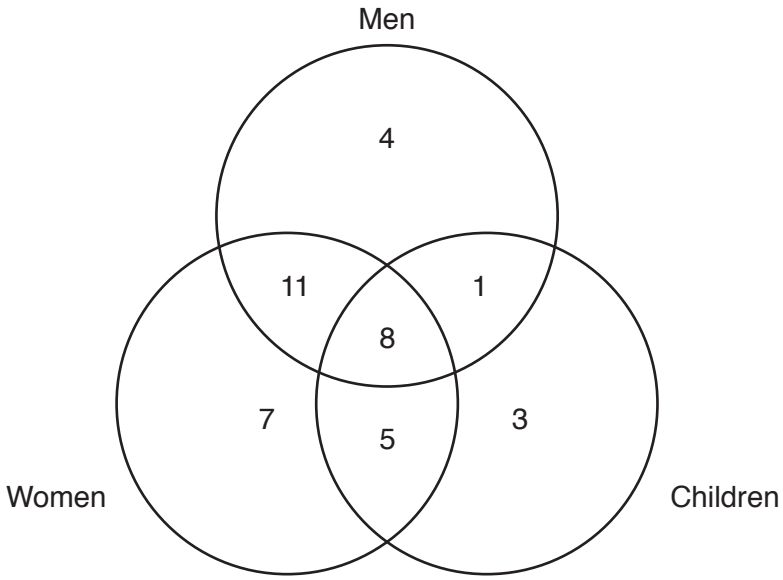
It is known that, on a mountain near the town, the atmospheric pressure is usually about 80 mb lower than it is in the town.

(ii) Write down estimates for the mean and range of the atmospheric pressure on the mountain at mid-day for this week.

Mean = ...

Range = ...[2]

4 The diagram below shows the number of stores in a shopping mall that sell clothes for one or more of men, women and children.



Use this information to find the number of stores that sell clothes for

(i) children,

.....[1]

(ii) men and women,

.....[1]

(iii) women or children or both.

.....[2]

Later, two of the stores that sell clothes for men and women but not children start selling clothes for children also.

Find, after this change, the number of stores that now sell clothes for

(iv) men and women only,

.....[1]

(v) men and children.

.....[1]

5 On an examination paper there are four questions, numbered 1, 2, 3 and 4. Candidates are instructed to answer any three questions, but not more than three.
At the examination board the computer print-out shows the following information for the questions answered by candidates from a particular school.

	Questions answered				
	1, 2 and 3	1, 2 and 4	1, 3 and 4	2, 3 and 4	1, 2, 3 and 4
Number of candidates	18	23	15	28	3

For checking the marking, a manager at the board selects the answer paper from one of these candidates at random.

Find the probability that the candidate

(i) had not followed the examination instructions,

.....[1]

(ii) had answered Question 3,

.....[1]

(iii) had answered Question 2, given that the candidate had followed the examination instructions.

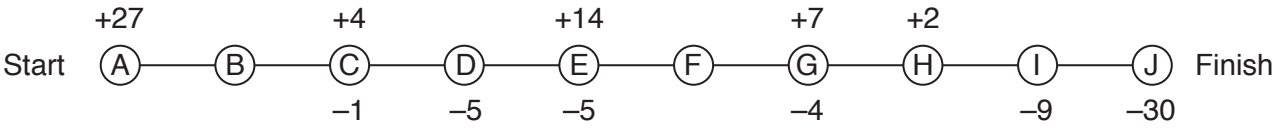
.....[1]

If, instead of selecting one, the manager selects two answer papers at random,

(iv) find the probability that one candidate had, and one candidate had not, followed the examination instructions.

.....[3]

6 Rong and Shui survey the passengers on one journey along a particular bus route.
Rong records the number of passengers boarding, and alighting from, the bus at each point along the route. Her raw data is as follows.



For example, at the start of the journey 27 passengers boarded the empty bus, and at stop C, 4 passengers boarded the bus and 1 passenger alighted from the bus.

Assuming that each passenger boarded and alighted from the bus once only, find, for this journey,

(i) the number of passengers who travelled on the route,

.....[2]

(ii) the least and greatest number of passengers travelling on the bus between stops at any one time.

Least = ...

Greatest = ...[3]

Shui asks a sample of the passengers to rate their opinions of bus services on the route, on each of the aspects punctuality, cost, and comfort, on a scale from 0 (very poor) to 4 (very good). From the ratings he calculates the measures shown in the table below.

Aspect	*Mean*	*Standard deviation*
Punctuality	1.0	0.63
Cost	2.0	1.41
Comfort	2.8	0.75

(iii) State, for which one of the aspects punctuality, cost, or comfort, passengers are generally

(a) most satisfied,

.....[1]

(b) least in agreement,

.....[1]

(c) least satisfied and most in agreement.

.....[1]

Section B [64 marks]

Answer not more than **four** of the questions 7 to 11.

Each question in this section carries 16 marks.

7 In this question calculate all pass rates as percentages, that is, as the number of passes per 100 enrolments.

At Yarvard University, the academic ability of students enrolled, based on school performance, is recorded as one of excellent, very good, good or moderate.
The table below gives information on the number of enrolments and number of passes in Economics at the University, together with the standard population of enrolments for universities in the area.

Ability group	*Number of passes*	*Number of enrolments*	*Ability group pass rate*	*Standard population of enrolments* (%)
Excellent	48	48		20
Very good	68	80		35
Good	20	32		30
Moderate	11	20		15

(i) Show that the crude pass rate for this course, correct to 1 decimal place, is 81.7%.

[3]

(ii) Calculate the pass rate for each ability group and insert the values in the table above.

[2]

(iii) Calculate the standardised pass rate for this course at Yarvard University.

.....[4]

The table below gives information on the pass rate, over the same period of time, for students of Economics at Hale University, which is situated in the same area as Yarvard University.

Ability group	*Ability group pass rate*	*Number of enrolments*
Excellent	100.0	45
Very good	83.3	78
Good	65.9	44
Moderate	60.6	33

Calculate, for this course at Hale University,

(iv) the crude pass rate,

.....[3]

(v) the standardised pass rate, using the same standard population as for Yarvard University.

.....[2]

(vi) State, with a reason, which of the two universities appears to provide the higher quality teaching in Economics.

.....

.....

.....[2]

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[Turn over for Question 8]

8 Tariq lives in a hill village but works in a fuel station on the main road below the village. He walks down the hill from home to work in the morning, and walks back up the hill from work to home in the evening.
The following table summarises his daily walking time from home to work over 60 working days.

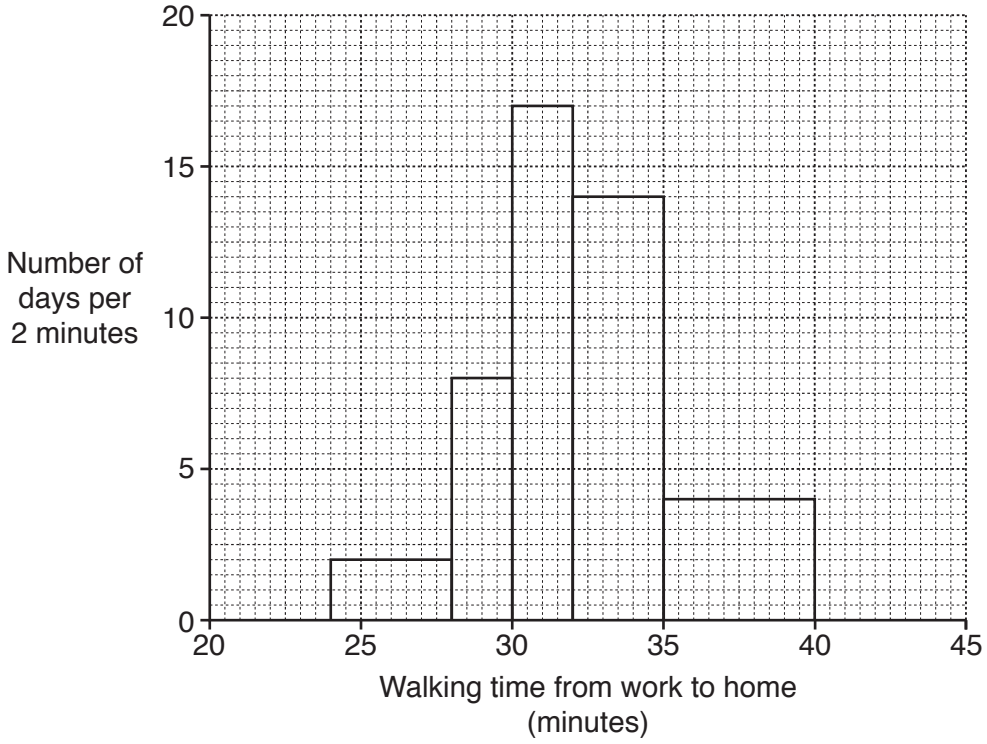
Daily walking time from home to work (minutes)	*Number of days*	
16 – under 18	5	
18 – under 20	14	
20 – under 22	19	
22 – under 24	15	
24 – under 28	7	

(i) Estimate, in minutes, the mean and standard deviation of these walking times. Give your answers to 3 significant figures.

Mean = ...

Standard deviation = ...[7]

The following histogram summarises Tariq's daily walking time from work to home for the same 60 days.



(ii) Use the histogram to complete the following table.

Daily walking time from work to home (minutes)	*Number of days*
24 – under 28	
28 – under 30	
30 – under 32	
32 – under 35	
35 – under 40	

[5]

(iii) Estimate the total time Tariq takes, on average, walking to and from work each day. Give your answer to the nearest minute.

.....[4]

9 The following table summarises the daily water consumption of a family over a period of 80 days.

Water consumption (litres)	*Number of days*	*Cumulative frequency*
200 – under 250	4	
250 – under 300	11	
300 – under 350	20	
350 – under 400	25	
400 – under 450	14	
450 – under 500	6	

(i) Complete the cumulative frequency column in the table. [1]

(ii) Plot the cumulative frequencies on the grid opposite, joining the points by a smooth curve. [3]

(iii) Use the graph to estimate, for the daily water consumption,

(a) the median,

.....[1]

(b) the interquartile range,

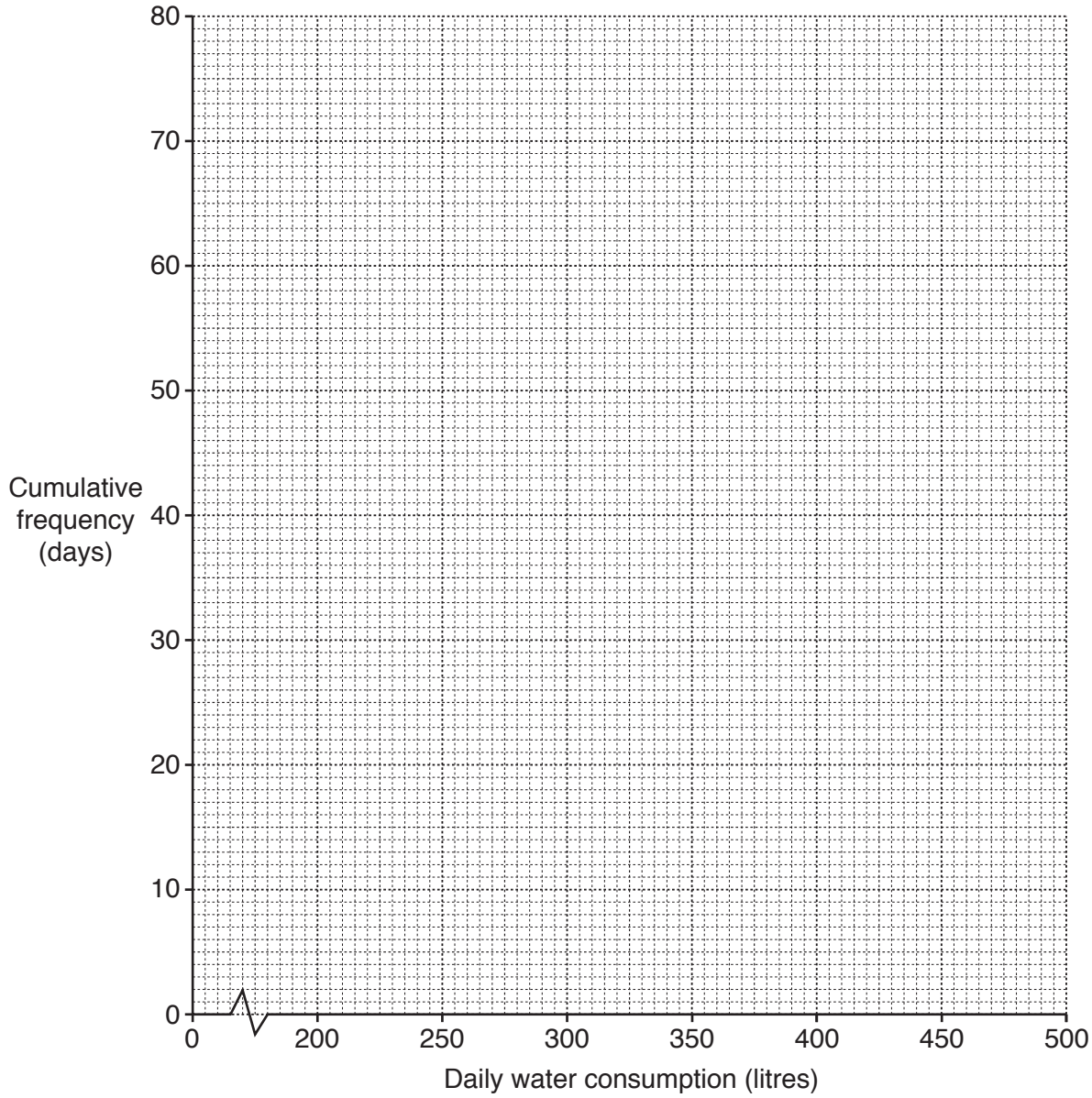
.....[4]

(c) the value of p, if the pth percentile is 375 litres.

.....[2]

(iv) Use your answer to part **(iii)(c)** to find the probability that, on any one day, the water consumption is more than 375 litres.

.....[1]



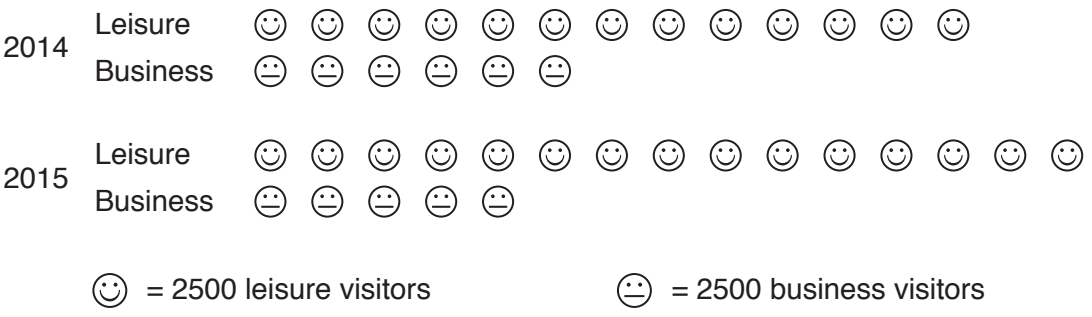
The water company charges $2.50 per cubic metre for water consumed, plus an additional service charge of $0.25 per day.

Assuming that the mean and median daily water consumption are approximately the same, and given that 1000 litres = 1 cubic metre,

(v) estimate the total amount owed by the family to the water company for these 80 days.

.....[4]

10 The numbers of visitors staying in a particular town for leisure and business, in the years 2014 and 2015, are shown in the pictograms below.



☺ = 2500 leisure visitors 😐 = 2500 business visitors

(i) State the number of visitors who stayed in the town for business in 2014.

.....[1]

(ii) How many more visitors stayed in the town for leisure than business in 2015?

.....[2]

(iii) Calculate the percentage increase, from 2014 to 2015, in the number of visitors who stayed in the town for leisure.

.....[2]

The town's tourist office provides the following information on hotels in the town.

Hotel	*Facilities*
Royal	Ⓟ ↑↓ ♿ 🖱
Mountain View	Ⓟ 🏊
Palm Beach	Ⓟ ♿ 🖱
Commercial	Ⓟ ↑↓ ♿ 🖱
Panorama	♿ 🏊 🖱
Central	↑↓ ♿ 🖱 ♫

Key

Ⓟ Car park	↑↓ Lift	♿ Wheelchair access
🏊 Swimming pool	🖱 Free internet access	♫ Regular entertainment

(iv) If a visitor staying in the town chooses one of these hotels at random, find the probability that the hotel

(a) has a lift and wheelchair access,

.....[1]

(b) has a car park or free internet access but not both,

.....[1]

(c) does not have a swimming pool, given that it does not provide regular entertainment.

.....[1]

The tourist office estimates that 30% of all visitors staying in the town for business choose The Commercial Hotel, and that the remainder are equally likely to choose one of the other five hotels.

(v) Estimate the decrease, from 2014 to 2015, in the number of visitors staying in the town for business who chose The Palm Beach Hotel.

.....[3]

(vi) A saleswoman comes to stay in the town to make new business contacts.

Estimate the probability that she chooses a hotel with wheelchair access.

.....[2]

(vii) Three visitors (who were old classmates, but now work for different companies) come to stay in the town for a business conference.

Assuming they make choices independently of each other, estimate the probability that they all choose the same hotel, and it has a lift.

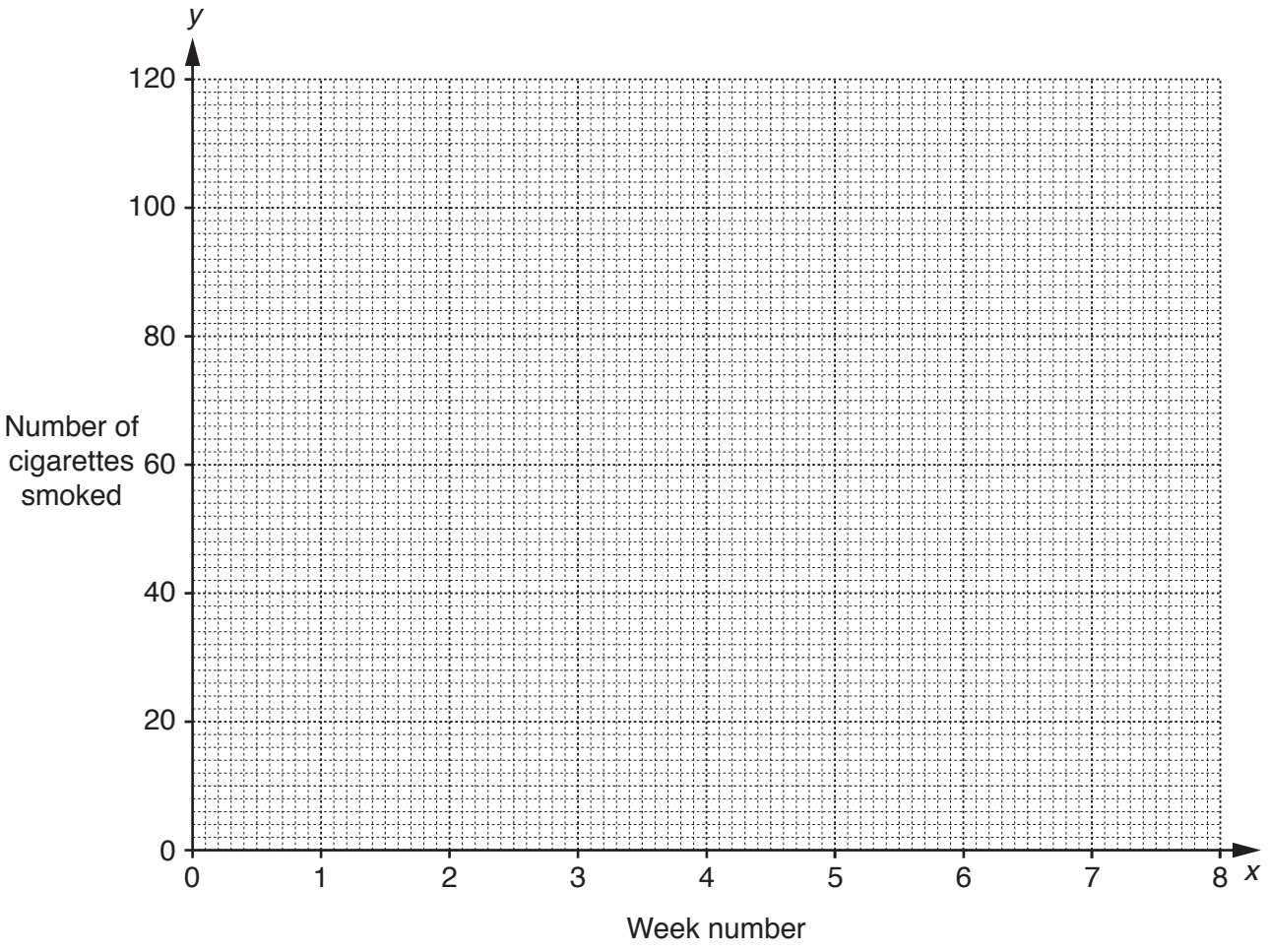
.....[3]

[Turn over

11 Alfred has smoked cigarettes for many years. He decides to try to stop by reducing his consumption gradually. His daughter Violet (a Statistics student) helps him by recording the number of cigarettes he smokes each week. Her results are shown in the following table.

Week number, x	1	2	3	4	5	6	7	8
Number of cigarettes smoked, y	108	95	98	83	67	72	57	52

(i) Plot these data on the grid below.



[2]

The data have an overall mean of (4.5, 79) and a lower semi-average of (2.5, 96).

(ii) Find the upper semi-average, and plot this and the two given averages on your graph.

[3]

(iii) Use your plotted averages to draw a line of best fit, and find its equation in the form $y = mx + c$.

.....[4]

(iv) Use the equation you have found in part **(iii)** to predict the additional number of weeks after which Alfred will have stopped smoking.

.....[2]

(v) Give a **statistical** reason why the prediction made in part **(iv)** might be unreliable.

.....

.....[1]

[Question 11 continues on the next page]

Alfred persuaded his friends George and Joseph, also cigarette smokers, to try to stop smoking, at the same time and using the same method as himself.
The equations Violet found for their lines of best fit were

$y = -7.9x + 131.5$ for George
and $y = -9.1x + 124.75$ for Joseph.

(vi) Use this information, together with your answer to part **(iii)**, to state, explaining your answers briefly, which one of Alfred, George and Joseph

(a) originally smoked most cigarettes,

.....

.....

.....[2]

(b) was making the fastest progress towards stopping smoking.

.....

.....

.....[2]