Surname	Centre Number	Candidate Number
Other Names		0

GCSE LINKED PAIR PILOT

4362/02

W15-4362-02

APPLICATIONS OF MATHEMATICS

UNIT 2: Financial, Business and Other Applications

HIGHER TIER

A.M. WEDNESDAY, 21 January 2015

2 hours

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**5**	
3.	**10**	
4.	**9**	
5.	**10**	
6.	**7**	
7.	**6**	
8.	**4**	
9.	**9**	
10.	**14**	
11.	**7**	
12.	**6**	
13.	**8**	
Total	**100**	

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ADDITIONAL MATERIALS

A calculator will be required for this paper.

A ruler, a protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided.

Take π as 3·14 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication (including mathematical communication) used in your answer to question **3***(a)*.

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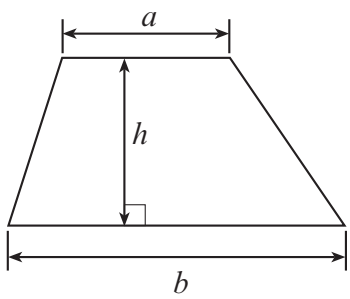
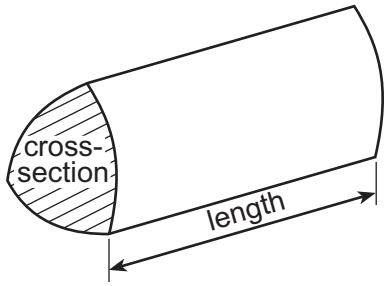
Formula List

Area of trapezium = $\frac{1}{2}(a + b)h$

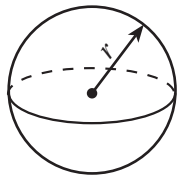


Volume of prism = area of cross-section × length



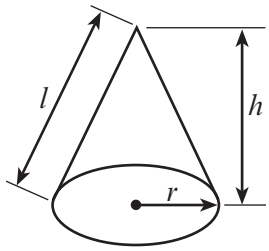
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$



Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$

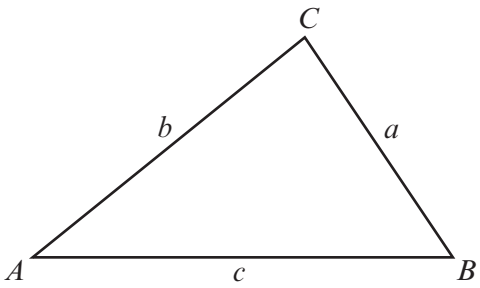


In any triangle ABC

Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle = $\frac{1}{2}ab \sin C$



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$

where $a \neq 0$ are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

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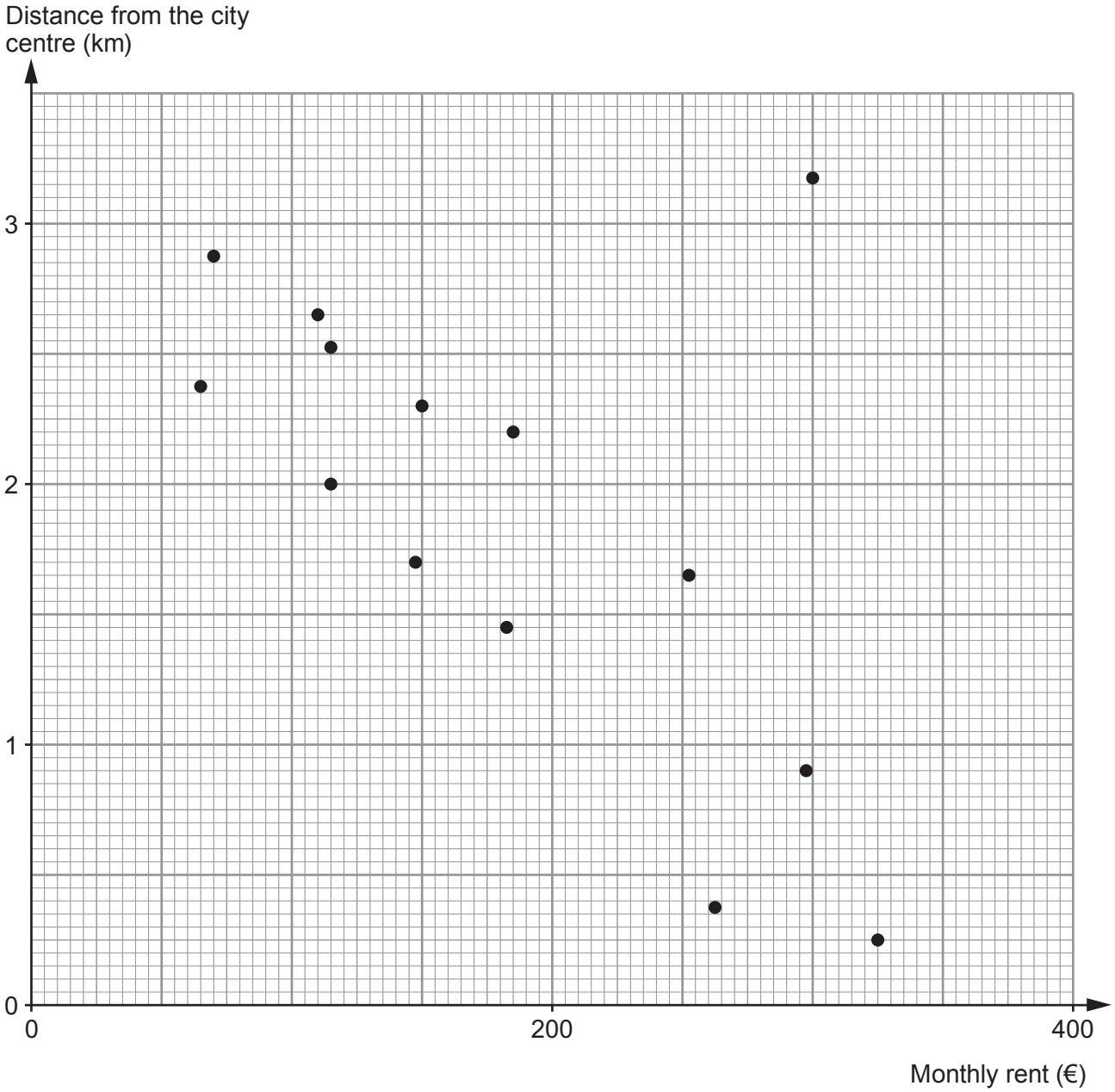
Examiner only

1. The scatter diagram displays data for furnished, two-bedroom apartments in a European city. It shows the monthly rental cost and the distance the apartment is from the city centre.



(a) How much is the monthly rental cost for the most expensive apartment? [1]

..... €

(b) How much is the monthly rental cost for the apartment furthest away from the city centre? [1]

..... €

Examiner only

(c) One of the apartments represented on the scatter diagram is a luxury apartment with electronic sound systems and computerised equipment.
Can you tell with certainty, from the scatter diagram, which is the luxury apartment?
You must give a reason for your answer. [1]

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(d) Draw, by eye, a line of best fit on the scatter diagram. [1]

(e) Use your line of best fit to estimate the monthly rental cost for a furnished, two-bedroom apartment 1·25 km from the city centre. [1]

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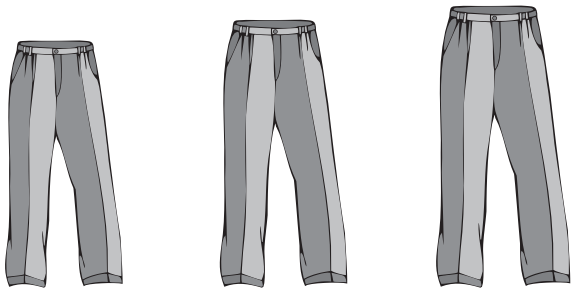
Examiner only

2. Men's trousers can be bought in different sizes: small, medium and large.



The chart below gives measurements for the different sizes of trousers.

Waist measurement, in centimetres correct to the nearest cm	Waist measurement, converted into inches correct to the nearest inch	Size
66 cm to 74 cm	26 inches to ..... inches	Small
75 cm to 90 cm	..... inches to 35 inches	Medium
91 cm to ..... cm	36 inches to 49 inches	Large

1 inch is approximately 2·54 cm

(a) Fill in the missing values in the table above. [3]

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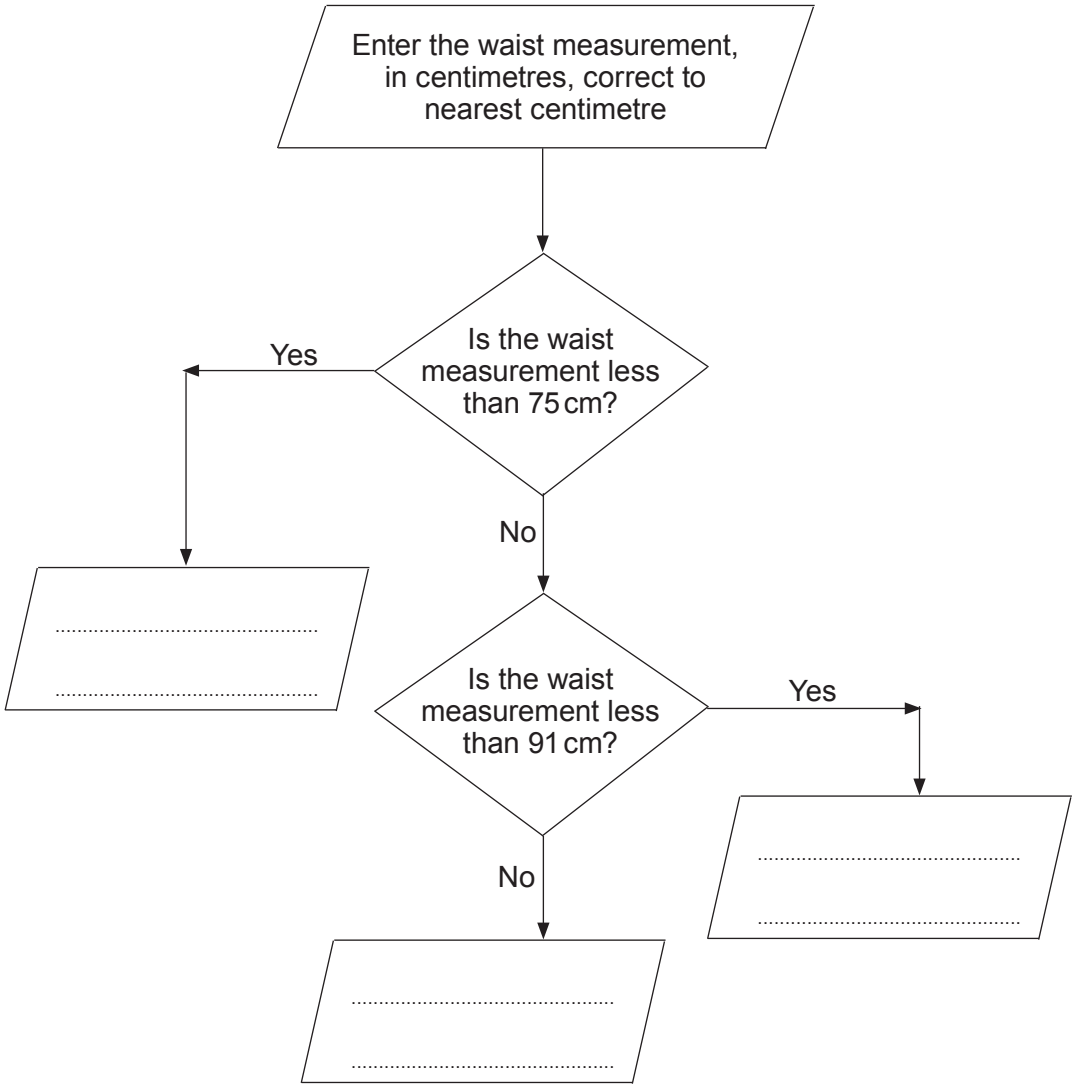
Examiner only

(b) The following section of a flowchart is used to find which size trousers to buy.



Complete the three empty output boxes in the flowchart above. [2]

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Examiner only

3. Dewi is going on holiday to China.

He has found the following rates for exchanging pounds sterling (£) and Chinese yuan (CYN), at a local exchange bureau.

Buying Chinese yuan (CYN)	£1 buys 9.28 CYN
Selling Chinese yuan (CYN)	9.42 CYN buys £1

The exchange bureau has all the possible sterling coins and notes.
Dewi knows that the exchange bureau only sells and buys CYN notes and that no coins are available or accepted.

The bureau has many of the following CYN notes.

(a) *You will be assessed on the quality of your written communication in this part of the question.*

Dewi has £460 to buy Chinese yuan.

Calculate
- the maximum number of CYN Dewi can buy, and
- how much, to the nearest penny, this will cost him.

You must show all your working. [7]

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Examiner only

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(b) It would cost Dewi £100 to buy 928 CYN.
Dewi states that he will lose money when he changes any CYN notes that he buys, back into pounds.
How much would Dewi lose in changing 928 CYN back into pounds? [3]

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Examiner only

4. Oil is stored in cylindrical drums.

(a) Each oil drum has a diameter of 46 cm and a height of 125 cm.
Calculate the volume of an oil drum.
Give your answer in litres. [3]

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(b) A different oil drum holds 150 litres of oil.
The oil from 4500 of these drums is sold for £1.2 million.
Calculate the cost of 1 litre of this oil. [3]

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Examiner only

(c) A barrel contains 159 litres of oil.
This produces 1700 kilowatt hours of energy.

Complete the sentences below.

1000 kilowatt hours of energy can be produced from ..... % of a barrel of oil.

This is ..... litres of oil. [3]

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Examiner only

5. Warren plays number games on his computer.
He keeps a record of his scores for each of *Bubble*, *Flowthru*, *Count4u* and *Splot* in a spreadsheet.
The maximum scores are shown in the section of Warren's spreadsheet shown below.
Some of the other entries are missing.

	A	B	C	D	E	F	G	H
1	**Numbers game**	**Maximum score for each game**	**Game 1**	**Game 2**	**Game 3**	**Game 4**	**Total score**	**Total score as a percentage**
2	*Bubble*	20	12	10	6	14	42	52·5
3	*Flowthru*	30	7	6	3	11	.....	.....
4	*Count4u*	10	6	4	7	6	.....	.....
5	*Splot*	4	3	1	0	.....	.....	50·0

(a) Write down a formula that could be used in the spreadsheet to calculate the entries for the following cells. [5]

G3

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H3

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Examiner only

(b) Complete this section of the spreadsheet by calculating the values of the missing entries in columns F, G and H. [5]

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Examiner only

6. Margo used a stem-and-leaf diagram to record the prices of two makes of toaster, *Jenkins* and *Hollow Electric*, on display in various department stores.
Margo's stem-and-leaf diagram is shown below.

Jenkins					*Hollow Electric*			
		1	0	6	0	2		
			2	5	4			
8	7	7	6	4	3	7	8	8
	2	2	2	3	0	3		
		8	6	2	8	9		

Key: *Jenkins* 2 | 5 represents £52
Hollow Electric 2 | 9 represents £29

(a) For how many *Hollow Electric* toasters did Margo record the price? [1]

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(b) What is the price of the most expensive toaster that Margo recorded? [1]

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(c) Complete the following table.

	Median (£)	Range (£)	Mode (£)
Jenkins			
Hollow Electric			

[4]

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(d) On average, which of the two makes of toaster seems to be the cheaper?
You must give a reason for your answer. [1]

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Examiner only

7. Glyn employs two people, Ben and Ceri.
Ben and Ceri are paid at different hourly rates.

Glyn has recorded how many hours Ben and Ceri have worked on Monday and Tuesday.
He has also recorded the total amount he has paid out in wages.

Day	Number of hours worked		Total pay (£)
	Ben	Ceri	
Monday	6	5	116
Tuesday	4	8	138

Use an algebraic method to calculate how much Ben and Ceri are paid per hour. [6]

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Ben is paid £ ..... per hour

Ceri is paid £ ..... per hour

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Examiner only

8. *Dragon Estate Agents* have a rectangular sign on the outside wall of their office building.

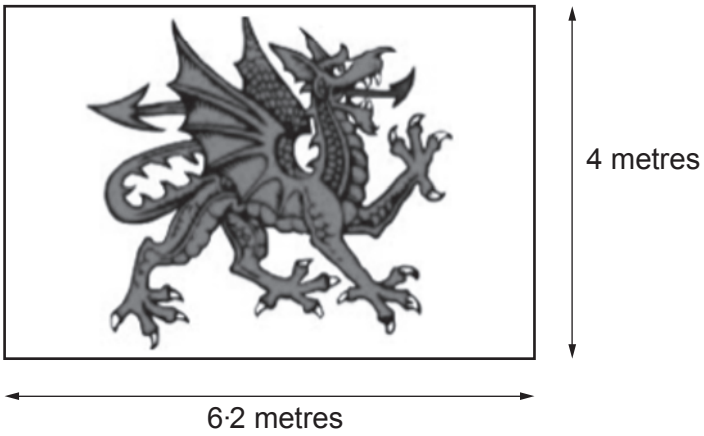

Diagram not drawn to scale

(a) The manager, Leo, wants to make badges for all staff to wear.
Leo wants the badge to be **similar** to the sign.

The height of the badge is 2·4 cm.

By calculating the length of the badge, find the area of the **badge**. [3]

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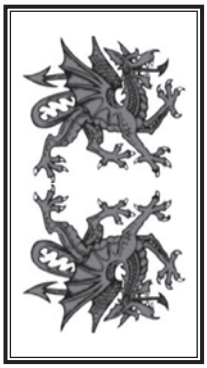
Examiner only

(b) The deputy manager, Morag, says that the badge doesn't look eye-catching enough. Morag suggests a new style, as shown below.

New style of badge.



Leo says,
"I don't like the new style of badge as it has no symmetry.
The original badge with a single dragon had rotational symmetry."

Is Leo correct in his statement?
You must give a reason for your answer. [1]

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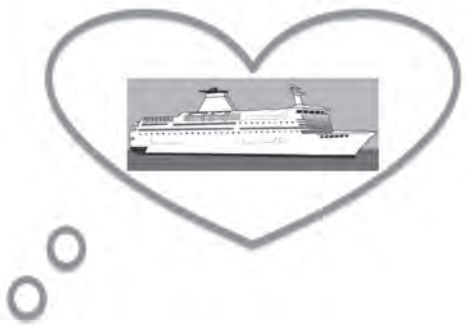
Examiner only

9. *(a)* Bryn is planning to go on a cruise when he retires in 15 years' time.



He has £5600 to invest.
In 15 years' time, he is hoping to have £7000 to spend on the retirement cruise.
He has noticed an advertisement for a savings account paying 1·85% AER.

By investing his £5600 in the savings account for 15 years, will Bryn have £7000 to spend on the cruise?
You must show all your working. [4]

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Examiner only

(b) Nia wants to invest £2000.
Greenash Building Society has a savings account offering 2·18% per annum, with interest paid annually.
Downtown Building Society has a savings account offering 2·15% per annum, with interest paid monthly.

$$\text{AER \%} = 100\left(1+\frac{r}{100n}\right)^n - 100$$

where
n is the number of times per year that interest is paid
r is the gross interest rate as a percentage

By comparing AERs, advise which account will offer Nia the better interest on her investment.
You must show all your working. [5]

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Examiner only

10. Thelma is selling three plots of land in an auction.
She needs to advertise the perimeters of each of the plots of land.
The sketch below shows the measurements that Thelma has taken.
She has added her notes about the shape of some of the plots.

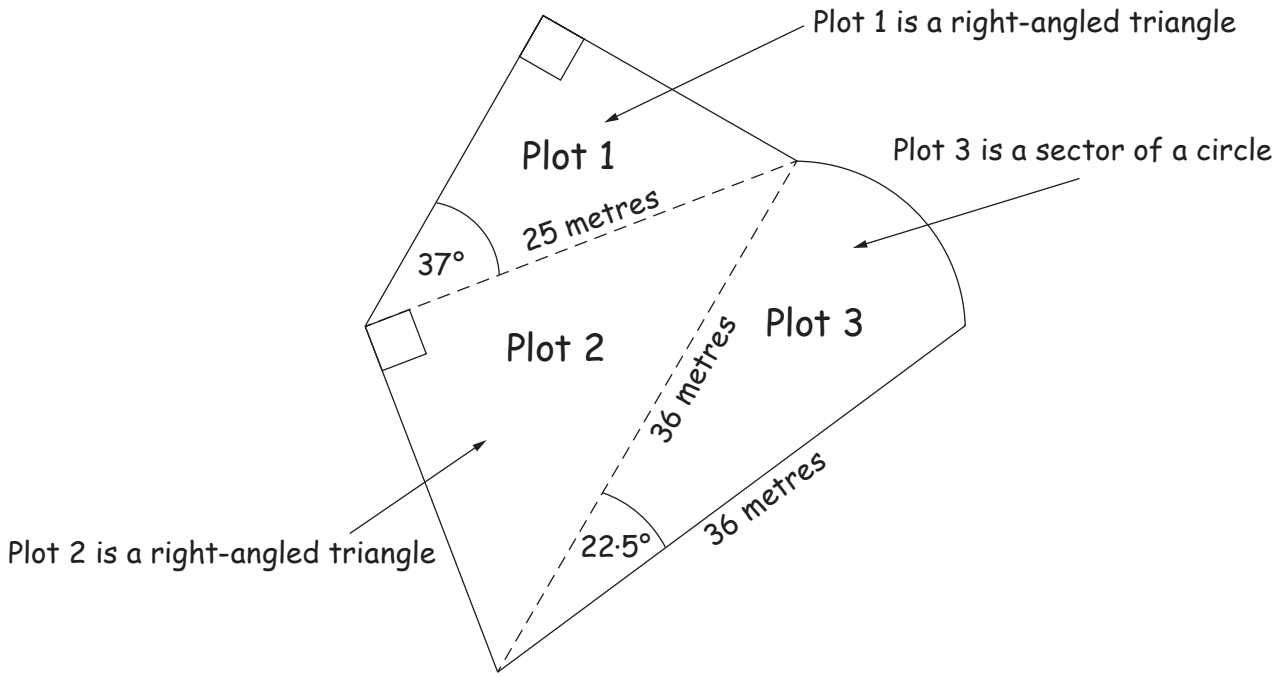

Diagram not drawn to scale

Calculate the perimeter of each of the plots of land.
Give your final answers correct to the nearest metre.
You must show all your working. [14]

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Perimeter of Plot 1 is ..... metres, correct to the nearest metre

Perimeter of Plot 2 is ..... metres, correct to the nearest metre

Perimeter of Plot 3 is ..... metres, correct to the nearest metre

14

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11. A DIY store sells two types of paving blocks: brown rectangular and green square.

Brown rectangular paving blocks cost £0.20 each.
Green square paving blocks cost £0.30 each.

The DIY store manager says that last week fewer than 4000 paving blocks were sold and more than £960 was taken from sales of paving blocks.

Let B represent the number of brown rectangular paving blocks sold.
Let G represent the number of green square paving blocks sold.

(a) Write down two inequalities, in terms of B and G, that satisfy the information given by the DIY store manager. [2]

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(b) Use the graph paper opposite to find a region that is satisfied by your inequalities. You must clearly indicate your region. [3]

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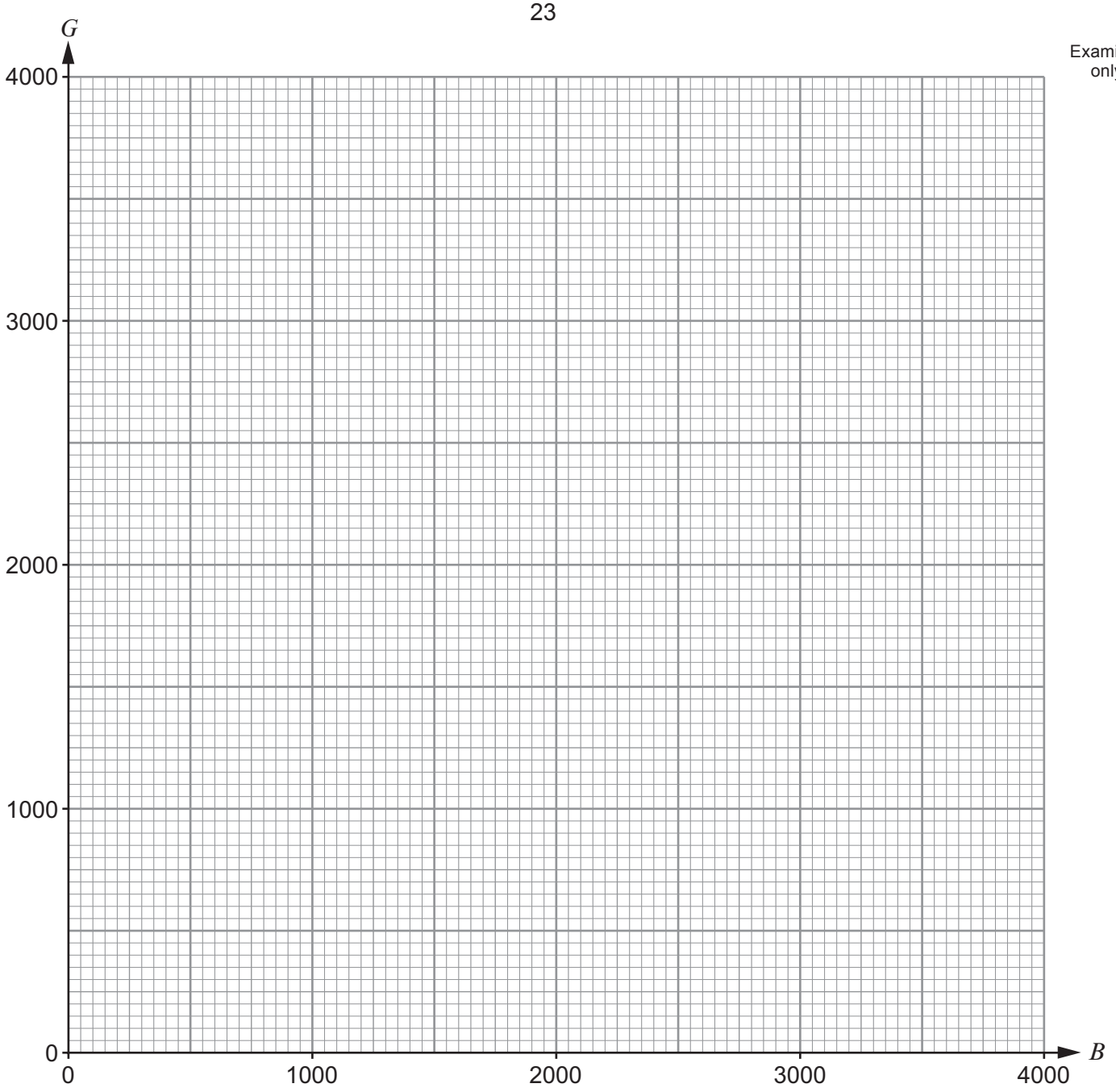

(c) Here are some statements made by sales assistants about the sales of paving blocks last week.

Ifor said, "1500 brown and 2000 green were sold."

Simone said, "500 brown and 3000 green were sold."

Use your graph to complete the following table to indicate whether each statement could be true or not.
You **must show on your graph** how you justify your decisions. [2]

Name	Statement	Could be true? Yes or No
Ifor	1500 brown and 2000 green were sold	
Simone	500 brown and 3000 green were sold	

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12. The volume of water is measured as it flows into a tank.
It is found that 300 litres flows into the tank in 4 minutes.
The measurement of the volume is accurate to the nearest 5 litres.
The measurement of the time is accurate to the nearest 2 seconds.

Calculate the least and greatest rate of flow of the water.
Give your answer in litres per second, correct to 2 decimal places. [6]

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Least rate of flow is ..... litres per second, to 2 decimal places.

Greatest rate of flow is ..... litres per second, to 2 decimal places.

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13. Different formulae can be used to calculate the *CPI* and the *RPI*, and to measure inflation. For example, there is the Carli formula and also the Dutot formula.
The Carli formula calculates the mean of relative prices, giving the Carli index.
The Dutot formula measures the ratio of mean prices, giving the Dutot index.

Example
The prices of apples are compared over a two-month period.
Prices per kg of apples in 3 different supermarkets are recorded.

	Price per kg of apples (£)	
Supermarket	1st March	1st April
A	1.20	1.20
B	0.85	0.80
C	1.00	0.90

Formulae for calculating each index for the **3 pairs of apple prices** are:

$$\text{Carli index} = \frac{\left(\frac{2^{nd}\text{ month for A}}{1^{st}\text{ month for A}} + \frac{2^{nd}\text{ month for B}}{1^{st}\text{ month for B}} + \frac{2^{nd}\text{ month for C}}{1^{st}\text{ month for C}}\right)}{3} \times 100$$

For the apple comparison:

$$\text{Carli index} = \frac{\frac{1.20}{1.20} + \frac{0.80}{0.85} + \frac{0.90}{1.00}}{3} \times 100$$

$$= (2.841176471... \div 3) \times 100$$

$$= 94.7$$

$$\text{Dutot index} = \left(\frac{\frac{2^{nd}\text{ month for A} + 2^{nd}\text{ month for B} + 2^{nd}\text{ month for C}}{3}}{\frac{1^{st}\text{ month for A} + 1^{st}\text{ month for B} + 1^{st}\text{ month for C}}{3}}\right) \times 100$$

For the apple comparison:

$$\text{Dutot index} = \frac{\frac{(1.20 + 0.80 + 0.90)}{3}}{\frac{(1.20 + 0.85 + 1.00)}{3}} \times 100$$

$$= \frac{0.96666666666...}{1.01666666666...} \times 100$$

$$= 95.1$$

Conclusion: According to the Carli index, the price of apples fell by 5.3%
According to the Dutot index, the price of apples fell by 4.9%

Examiner only

(a) The prices of bananas are compared over a two-month period.
Prices per kg of bananas in **4 different supermarkets** are recorded.

	Price per kg of bananas (£)	
Supermarket	1st June	1st July
A	0.92	1.02
B	0.91	0.93
C	0.90	0.92
D	0.94	0.94

Amend the formulae given in the example and hence calculate each index for the **4 pairs of banana prices**.
You must show your working.

(i) Carli index [3]

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(ii) Dutot index [3]

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Examiner only

(b) Use your answers to complete these statements.

Conclusion:

According to the Carli index, the price of bananas increased by ..... %

According to the Dutot index, the price of bananas increased by ..... %

[1]

(c) How could the Dutot formula be written in its simplest form? [1]

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END OF PAPER